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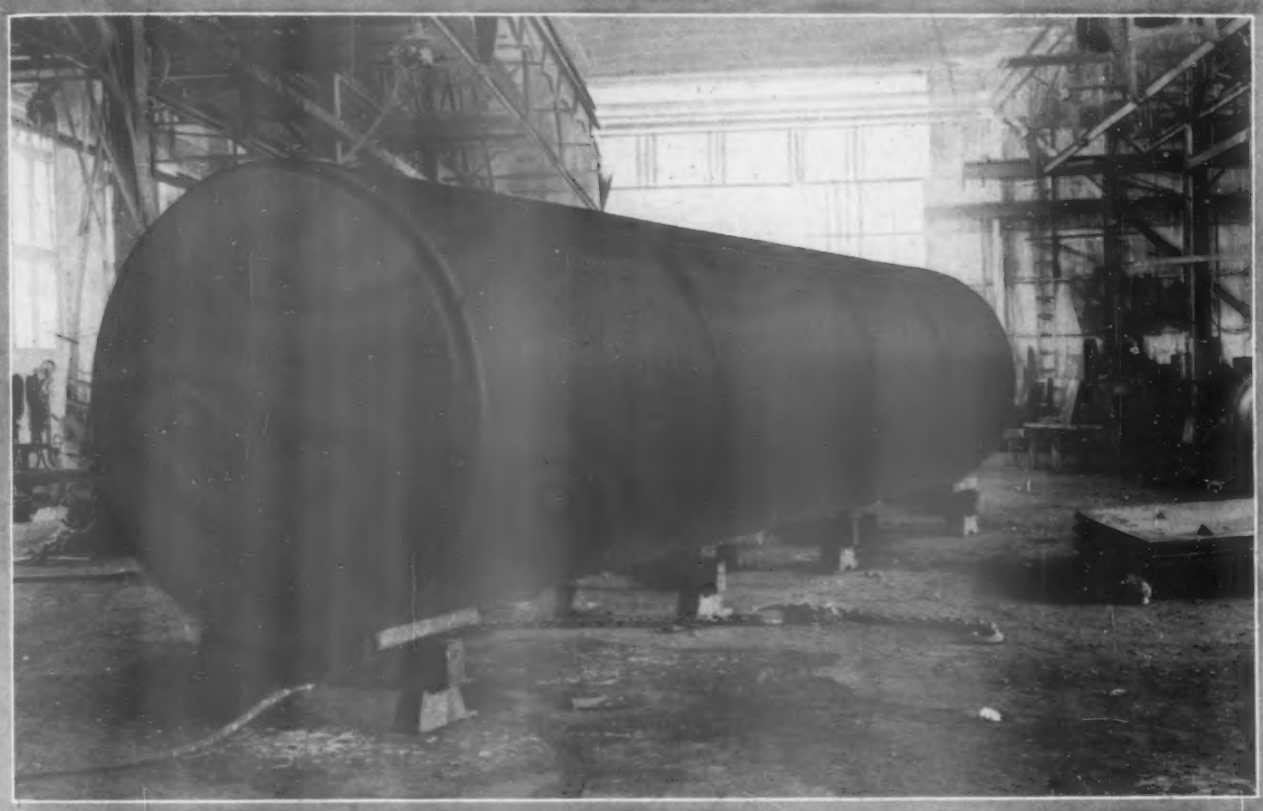

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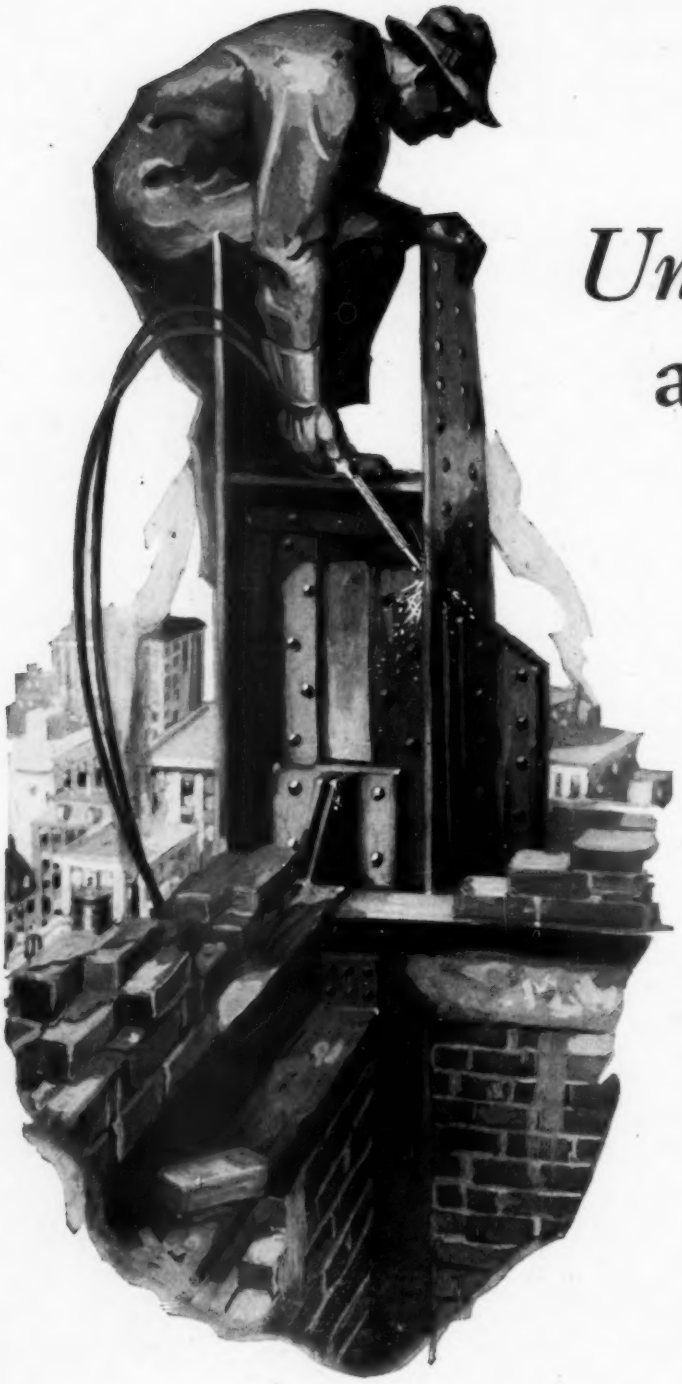

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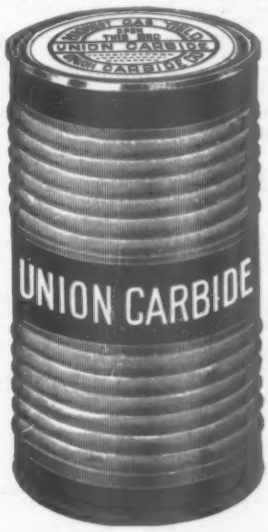

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Beaver..... 359 Beaver St.
DuBois....Weber Ave. and Franklin St.
East Greensburg..Clark and George Sts.
Erie..... 1426 Chestnut St.
Harrisburg.....25 S. Tenth St.
Johnstown, Messenger St. and B. & O. R.R.
Pittsburgh .....
.....1202 Chamber of Commerce Bldg.
Pottsville....Railroad and Sanderson St.
Scranton.....Penn Ave. and Vine St.
Shamokin.....Fifth and Walnut Sts.
Williamsport.....Canal and Court Sts.

SOUTH CAROLINA
Charleston..3 N. Liberty St., Phone 2716

TENNESSEE
Chattanooga .....
...627 Volunteer State Insurance Bldg.
Knoxville.....426 West Depot Ave.
Memphis.....671 South Main St.
Nashville..... 105-107-109 Broadway

TEXAS
Dallas.....Wood and Market Sts.
El Paso..First and Kansas Sts., Phone 50
Houston .....
..Baker and Cedar Sts., P. O. Box 1214
San Antonio.....115 Medina St.
Waco..Thirteenth & Mary Sts., Phone 23

UTAH
Salt Lake City..108 W. Second South St.

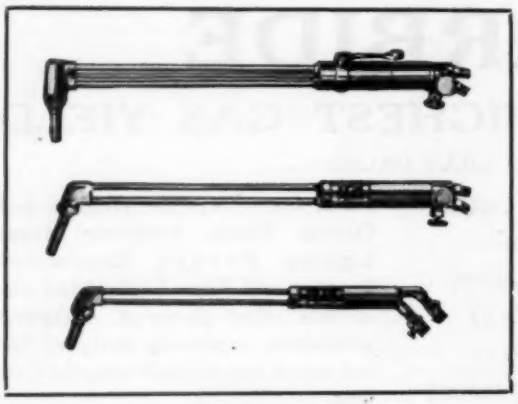
VIRGINIA
Lynchburg..... 1324 Commerce St.
Norfolk..... 513 Front St.
Richmond.....18th and Cary Sts.

WEST VIRGINIA
Bluefield.....195 Roanoke St.
Charleston..Broad St. and K. & M. R. R.
Elkins.....Railroad Ave. and First St.
Fairmont ..... "A" St.
Huntington...Seventh Ave. & Eighth St.
Morgantown.....178 Clay St., Phone 20
Wheeling.....43rd and McCulloch St.

WASHINGTON
Seattle.....508 Westlake Ave., North
Spokane..162 So. Post St., Phone Riv-96

WISCONSIN
La Crosse.....Front and King Sts.
Madison..... 513-19 Williamson St.
Milwaukee..... 120 Jefferson St.

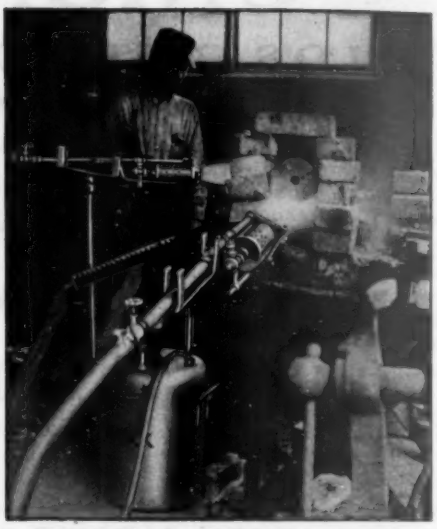
UNION CARBIDE IS EASILY OBTAINABLE EVERYWHERE



K-G
Cutting Welding
TORCHES
Any Length Desired
for Any Gas Desired

K-G Welding and Cutting Co., Inc.
Home Office and Factory
556 West 34th St., N. Y. City
SALES OFFICES:
Philadelphia, Pittsburgh, Chicago, Springfield, Mass. Norfolk

Reduce Overhead Expense



Welders do their preheating jobs at less cost than with charcoal or artificial gas.

There is absolutely no SMOKE or NOXIOUS GASES, and the DIRT that accumulates when charcoal is used is eliminated.

The burners are readily regulated to the desired flame by merely regulating the OIL VALVE.

HAUCK KEROSENE PREHEATERS are simple to OPERATE, and easy to HANDLE. They are equippel with hand pump; one pumping will operate the burner for three hours.

Write us for descriptive matter, or, still better, ask us to send you an outfit ON TRIAL.

HAUCK MANUFACTURING CO.
Makers of Oil Burning Equipment for Over Twenty Years
122 TENTH STREET : : : BROOKLYN, N. Y.

Hauck Mfg. Co.
International Oxygen Co.
The Imperial Brass Mfg. Co.
Oxweld Acetylene Co.
The Prest-O-Lite Co.
Superior Oxy-Acetylene Machine Co.
United States Welding Co.
Westinghouse Electric & Mfg. Co.
Burdett Oxygen Co.
Davis-Bournonville Co.
International Oxygen Co.
Kentucky Oxygen-Hydrogen Co.
Modern Engineering Co.
Prest-O-Lite Co.
Smith's Inventions, Inc.
Superior Oxy-Acetylene Machine Co.
Universal Oxygen Co.
The Imperial Brass Mfg. Co.
Torchweld Equipment Co.

TRUCKS (Cylinder Carriers)
Air Reduction Sales Co.
The Bastian-Blessing Co.
Burdett Oxygen Co.
Davis-Burnonville Co.
The Imperial Brass Mfg. Co.
Modern Engineering Co.
Superior Oxy-Acetylene Machine Co.
Torchweld Equipment Co.
United States Welding Co.
Universal Oxygen Co.

VALVES (For Oxygen Cylinders)
Air Reduction Sales Co.
Burdett Mfg. Co.
International Oxygen Co.
Universal Oxygen Co.

WELDING APPARATUS (Electric)
Electric Arc Welding & Cutting Co.
General Electric Co.
Gibb Instrument Co.
Lincoln Elec. Co.
Quasi-Arc Weldtrode Co.
Westinghouse Elec. Mfg. Co.

WELDERS' GLOVES
Air Reduction Sales Co.
Chicago Eye Shield Co.
Electric Arc Cutting & Welding Co.
International Oxygen Co.
The Imperial Brass Mfg. Co.
Transportation Engineering Corp.
Universal Oxygen Co.

WELDERS' GOGGLES
Air Reduction Sales Co.
Burdett Oxygen Co.
The Imperial Brass Mfg. Co.
Chicago Eye Shield Co
International Oxygen Co.
Modern Engineering Co.
Quasi-Arc Weldtrode Co.
Transportation Engineering Corp.
Universal Oxygen Co.

WELDERS MASKS
Chicago Eye Shield Co.
Electric Arc Welding and Cutting Co.
General Electric Co.
Torchweld Equipment Co.
Transportation Engineering Corp.

WELDING RODS AND WIRE
Air Reduction Sales Co.
Electric Arc Cutting & Welding Co.
Bierman-Everett Fdy Co.
Burdett Oxygen Co.
William Cramp & Son
Central Steel & Wire Co.
Iron City Foundry Co.
The Imperial Brass Mfg. Co.
International Oxygen Co.
Modern Engineering Co.
Oxweld Acetylene Co.
Page Steel & Wire Co.
Quasi-Arc Weldtrode Co.
Reid-Avery Co.
John A. Roebling's Sons Co.
Torchweld Equipment Co.
Transportation Engineering Corp.
Universal Oxygen Co.

WELDING ROD HOLDERS
C. Sorensen.

WIRE AND CABLE (Asbestos Insulated)
Central Steel & Wire Co.
D. & W. Fuse Works, General Electric Co.

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Davis-Bournonville

Garage and Small Machine Shop Carrying Case Welding Outfit

A new torch and equipment, packed in a neat fibre case complete is offered at the low price of $55. The outfit consists of the following:

1 Torch, Style No. 7000

3 Extension Tubes
Style No. 7017, 5 in. long
Style No. 7018, 10 in. long
Style No. 7019, 15 in. long

5 Welding Tips
Style 9, sizes assorted from No. 1 to No. 7

1 Decarbonizing Tube
Style No. 7020

1 Oxygen Regulator,
Style No. 5500

1 Acetylene Regulator
Style No. 5501

12 ft. Oxygen Hose, with Connections

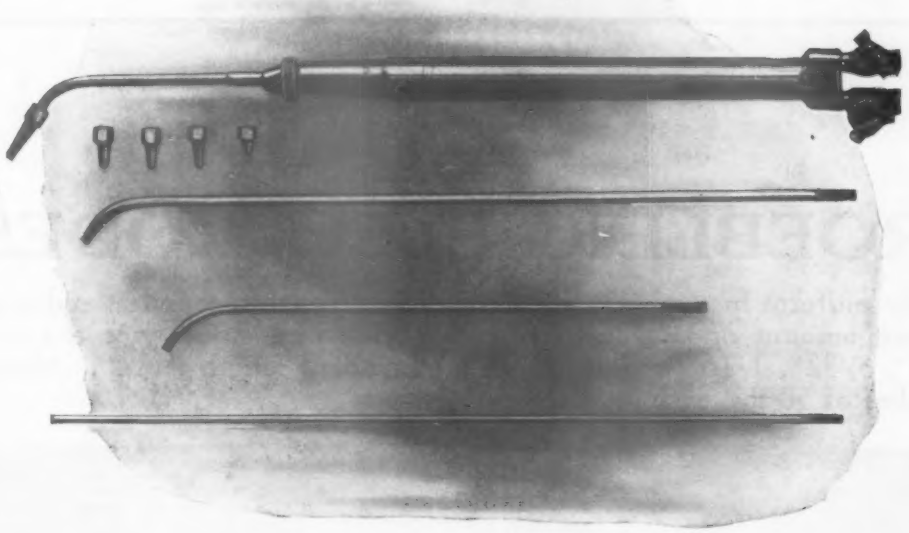
12 ft. Acetylene Hose, with Connections

1 Sparklighter

1 Pair Colored Glasses

1 Torch Wrench

1 Regulator Wrench



Price complete, packed in fibre case, as shown, $55. An assortment of welding rods and fluxes, necessary for average welding jobs packed in a wooden box, is furnished at $6 extra.

Price of Outfit in Canada $65.

Davis-Bournonville Company

FACTORY AND GENERAL OFFICES, JERSEY CITY, N. J.
BRANCHES IN PRINCIPAL CITIES

THE GEFEI

SEWING-MACHINE for SHEET-METAL

The revolutionary method of joining sheet metal (iron-steel-brass-tin) with

STRONG, LEAK-PROOF, CONTINUOUS WELDS AT HIGH SPEEDS AND LOW COSTS

has given the German Manufacturer the advantage for several years.

We now exhibit and offer these machines to the American Manufacturer.

Bring (or send) the product to be joined and obtain first hand information as to speeds, efficiencies and economies.

GIBB INSTRUMENT COMPANY

Main Office—General Motors Building, DETROIT, MICHIGAN

ROEBLING ELECTRODES

are positively uniform in quality. They make the strongest, soundest and toughest welds with the least amount of trouble in welding. Standard stock sizes are 1/4″, 3/16″, 5/32″, 1/8″, 3/32″, 1/16″ and 1/32″ Dia. Standard length is 14″. Shipped in burlapped bundles of 50 lbs. each.

ROEBLING GAS WELDING WIRE

is pure, uniform, soft, tough, free from occluded gases and oxides and free from injurious surface imperfections or mechanical faults. Standard material is copper coated to distinguish it from wire for electric welding. Supplied in 36″ standard lengths and in sizes 3/8″, 5/16″, 1/4″, 3/16″, 5/32″, 1/8″, 3/32″ and 1/16″ Dia. Ready for quick shipment in burlapped bundles of 50 lbs. each.

JOHN A. ROEBLING'S SONS COMPANY, Trenton, N. J.

New York Boston Chicago Philadelphia Pittsburgh Cleveland Atlanta
San Francisco Los Angeles Seattle Portland, Oregon

A NEW MEMBER of the SMITH FAMILY

Smith's No. 6 Welding and Cutting Torch
FIVE TORCHES FOR THE PRICE OF ONE
Write for particulars.

Some Older Members of Our Family

Smith's Kerosene Preheating Torch (the kind that does not have to be generated).

Smith's 30 lb., 50 lb., 100 lb. and 200 lb. Automatic Acetylene Generators.

Smith's Acetylene Soldering Iron.

Oxygen and Acetylene Regulators.

Lead Burning and Carbon Burning Torches.

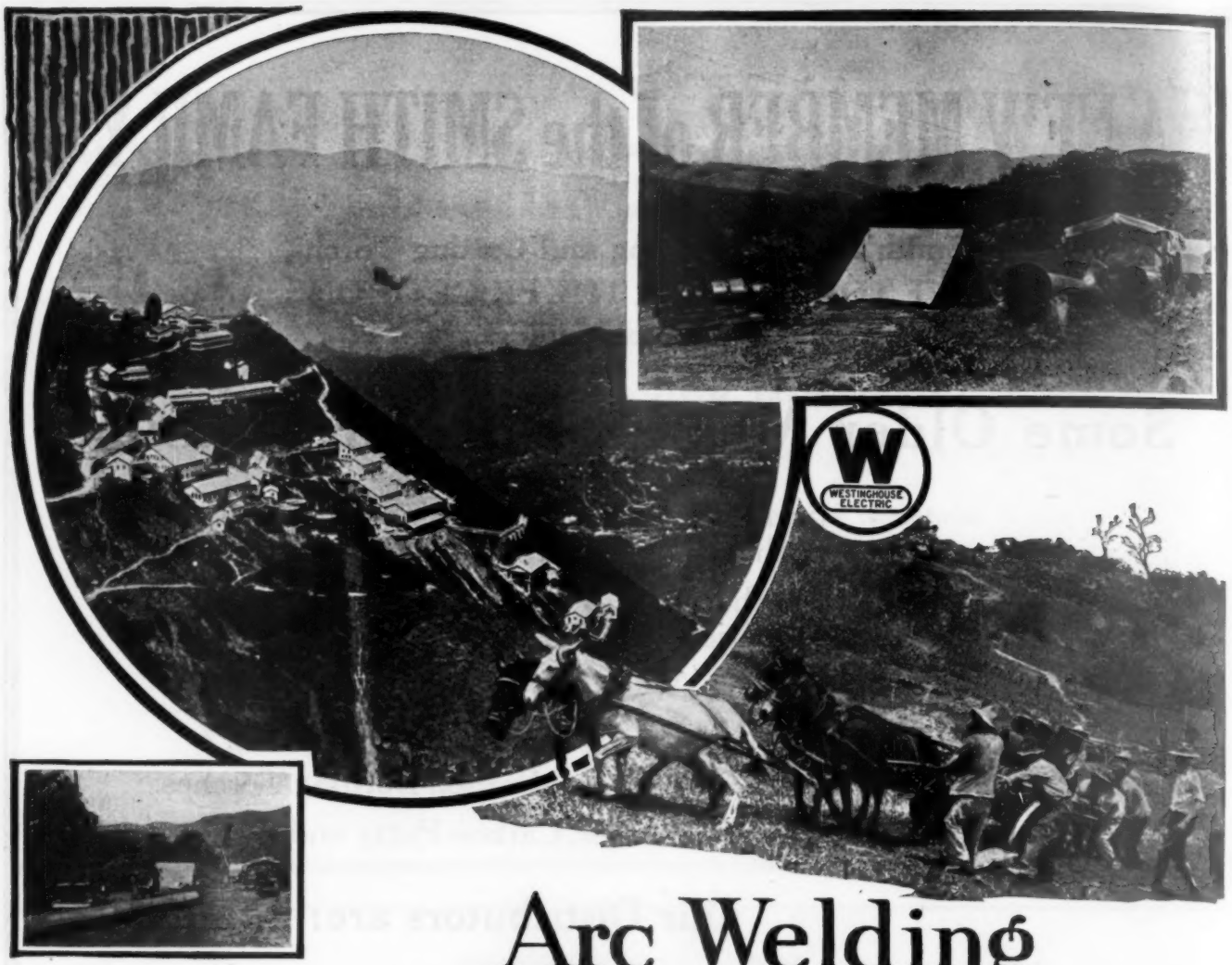
Cast Iron Solder, Carbon Putty and Fluxes.

Our Distributors are:

Campbell Iron Co., St. Louis, Mo.
Electric Appliance Co., Chicago, Ill.
Omaha Welding Co., Omaha, Nebr.
Bonniwell Calvin Iron Co., Kansas City, Mo.
Holter Hdwe. Co., Spokane, Wash.
James Supply Co., Chattanooga, Tenn.
Big Three Welding & Equipment Co., Fort Worth, Texas.
Williams Hdwe. Co., Minneapolis, Minn.
The Moore Hdwe. & Iron Co., Denver, Colo.
Young & Vann Supply Co., Birmingham, Ala.
Taylor Parker Co., Norfolk, Va.
Motor Mercantile Co., Salt Lake City, Utah.
Seattle Oxygen Co., Seattle, Wash.
Waterhouse & Lester Co., San Francisco, Calif.
Waterhouse & Lester Co., Los Angeles, Calif.
Waterhouse & Lester Co., Portland, Ore.
Motor Equipment Co., Wichita, Kans.
Shadbolt & Boyd Iron Co., Milwaukee, Wis.

SMITH'S
INVENTIONS
INCORPORATED

2617 Fourth Street S. E.
Minneapolis, Minn.



Arc Welding In Honduras, C.A.

3000 feet of 22 in. diameter pipe required repairs in San Jacinto, Honduras. Here is how it was done as told by the chief in charge.

"I need not go into details, it will be sufficient to say that the pipe was as thin as a piece of paper in some places while in others it was in perfect condition. The question arose as to which would be the cheaper, buy a new pipe, or repair the old one, so one of the worst lengths was taken out and repaired with the aid of our **Westinghouse welding outfit.** The result was we could repair the pipe and make it almost as good as new for one tenth the cost of a new pipe.

"The method employed to repair the pipe was the most simple possible. Three lengths were disconnected so that they could be turned around on the piers to make the welding operation as easy as possible for the operator. The defective places were then marked off, plates cut and bent to the required size and shape, put into place, and welded around the edges. This method may not appeal to some people, but 'the proof of the pudding is in the eating.' The pipe was then tested to double the working pressure and, barring a few beads of moisture appearing in places where the weld was slightly porous, the pipe was otherwise OK. These slight leaks only required a little tap with a hammer to exterminate them entirely."

Westinghouse Arc Welding Equipments are furnished in stationary or portable types for one or more operators and in all sizes from 175 to 1,000 amperes.

Westinghouse Electric & Manufacturing Co.
East Pittsburgh, Pa.
Offices in all principal American Cities

Westinghouse

Hy—What are you thankful for this Thanksgiving Day?
Oxy—I'm thankful because I'm not a turkey.

Many welders and cutters are thankful because they have discovered that they can save lots of time, labor and money by insisting upon oxygen that tests 99% pure or better.

Is there a **"99% purity clause"** in YOUR oxygen contract?

Electrolytic Oxygen and Hydrogen Plants Everywhere

CALIFORNIA
California Compressed Gas Co., Los Angeles
California Compressed Gas Co., Oakland

COLORADO
Colorado Compressed Gas Co., Denver

GEORGIA
Standard Gas Products Co., Atlanta

ILLINOIS
Acme Oxygen Co., Chicago
Burdett Oxygen & Hydrogen Co., Chicago
Electrox Co., Peoria
National Oxygen Co., Chicago
Swift & Co., Chicago

INDIANA
Indiana Oxygen Co., Indianapolis
Logansport Oxygen Co., Logansport

IOWA
Bettendorf Oxygen Hydrogen Co., Bettendorf

KENTUCKY
Kentucky Oxygen & Hydrogen Co., Louisville

MANITOBA
Auto-Lite Gas Co., Ltd., Winnipeg

MICHIGAN
Burdett Oxygen Co. of Detroit, Detroit
Michigan Ox-Hydric Co., Muskegon
National Oxygen & Machinery Co., Detroit

MINNESOTA
Commercial Gas Co., Minneapolis

MISSOURI
Oxygen Gas Co., Kansas City (two plants in Kansas City)
St. Louis Oxygen Co., St. Louis

MONTANA
Mountaineer Welders' Supply Co., Butte

NEBRASKA
The Balbach Co., Omaha

OHIO
Clarke Chemical Co., Wickliffe
Gas Products Co., Columbus
Ohio Electrolytic Oxygen Co., Cincinnati

OKLAHOMA
Burdett Oxygen Co. of Oklahoma, Oklahoma City

OREGON
Portland Oxygen & Hydrogen Co., Portland

PENNSYLVANIA
Burdett Oxygen Co., Philadelphia (plants at Chester and Norristown)
Burdett Oxygen & Hydrogen Co., Pittsburgh, Pa.
National Oxygen, Erie

TENNESSEE
Burdett Oxygen Co., Chattanooga

TEXAS
Burdett Oxygen Co. of Texas, Fort Worth
Magnolia Gas Products Co., Houston

UTAH
Utah Compressed Gas Co., Salt Lake City
Whitmore Oxygen Co., Salt Lake City

WASHINGTON
Washington Compressed Gas Co., Seattle

WISCONSIN
Universal Oxygen Co., Sheboygan
Wisconsin Oxygen & Hydrogen Co., Kenosha

BRITISH COLUMBIA
Compressed Gas Co., Ltd., Vancouver

Gas Products Association

801 Marquette Building **Chicago, Ill.**

SUN-LITE CARBIDE

PACKED IN BROWN DRUMS

For Acetylene Compressing Plants, Oxy-Acetylene Welding Plants, House Lighting Generators, Contractors' Torches, Etc.

IN 100 lb. DRUMS

In All Commercial Sizes:

3½" x 2"
2" x ½"
1¼" x ⅜"
¼" x 1/12"

MINERS' LAMP

Write for location of nearest sales agency, from which shipments will be made direct to consumer. Address all correspondence to the Home Office

GAS TANK RECHARGING COMPANY, MILWAUKEE, WISCONSIN

"RACO" Electrodes *and* Welding Wires

Blue Label

Colored labels in this style identify each different kind of RACO WIRE

The chemical analyses of the Seven different "Raco" Wires are published in an interesting booklet, the only one of its kind, which will be sent on request to any user of welding wires—no charge.

"Raco" Wires are sold under strict specification and are subject to rejection for any cause.

Rail facilities directly into the plant and a 500,000 pound stock, in 3-32 in., ⅛ in., 5-32 in., 3-16 in. and ¼ in. diameter make it generally possible to ship orders of any size, the day they are received.

Samples for testing and new current prices furnished promptly.

Reid-Avery Company

21st St. and Washington Ave.
PHILADELPHIA, PA.

THE LEADING JOURNALS OF THE WELDING INDUSTRY ENDORSE THE AIMS OF THE NEW PROMOTION CO.

"I am very much interested to know of your undertaking. The job welders throughout the United States will be very much interested, and certainly ought to use a service such as you are planning. I believe you ought to make a success of it. For our part, we will be glad to do everything we can to assist you."

L. B. Mackenzie, President
THE WELDING ENGINEER

"There should be a splendid field for your proposition here in Canada as well as in the United States. I assure you we will do all we can to push this thing along."

Jos. N. Robinson, Editor and Publisher
THE CANADIAN WELDER
(Formerly The Canadian Welding Journal)

"Your proposed service, properly handled, and marketed reasonably, should prove beneficial to the entire job welding field; and, sold avoiding duplication in a community, should be of very general interest. I shall be pleased to co-operate in any possible manner to assist in the extension of your work."

Harold W. Cook, Managing Editor
ACETYLENE JOURNAL

THE WELDING PROMOTION CO

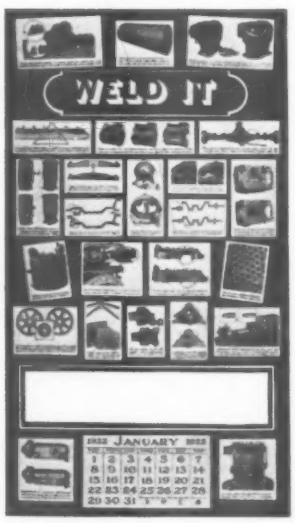
ANNOUNCES ITS FIRST IMPORTANT PRODUCTION

For General Use Everywhere By All Classes of Job Welders Keen for Bigger, Better Business

The First Real Advertising the Industry Ever Had to Spread the Practical Gospel of What Welding Is, and Can Do

THE WELDING PROMOTION COMPANY begins business endorsed and assisted by prominent manufacturers of welding supplies and equipment, and by the leading journals of the trade. We will work with welders on a co-operative basis, furnishing to them the very highest grade of advertising at very low prices made possible by a large volume of sales widely distributed. Through us, job welders everywhere can now secure direct aid, never before available, and will be able to profitably educate their prospects and customers to wider knowledge of welding uses and advantages. By this assistance we believe we can greatly help the job welding shop to create a better local understanding of its work, and we hope, in this way, to bring to every welder on our list more of the prosperity which his skill deserves.

412 Square Inches of Indoor Billboard to Hang 365 Days on Your Prospect's Wall



Your Calendar Will Be In 2 Colors Size 1½ x 2¼ Feet

Our first production aims to make us useful from the start to as many welders as possible, and to demonstrate to the entire industry what grade of expert work is to be expected in all our future advertising matter.

This first production is a calendar to advertise you for a year—an "indoor billboard" 2¼ feet high, 15 inches wide, printed in 2 colors *on the same fine quality paper used for this announcement.*

Every effort has been made to make our calendar admired. No man will throw it away. Few, if any, can resist hanging it prominently. Its handsome background is in imitation of red morocco leather, and is beautifully and skillfully designed to bring out 24 photographic illustrations with striking force. The panel above roughly reproduces what this rich background looks like, and below is given a complete list of illustrations which cover a wide range of the work the average welder is prepared to do. Welding processes in various stages are shown, also views before and after welding. Nothing in any picture indicates whether job has been done by gas, electricity or otherwise. There is therefore

NO CONFLICT WITH YOUR BUSINESS

Skilled artists have removed unimportant details. Important features are marked with bright red circles or arrows to bring out the points you will want to show to best advantage.

Below each picture in bold type is an explanation technically edited by a competent engineer, and written in words that carry a punch. The combination of words and pictures is a considerable education in how welding does many things more quickly and satisfactorily at lower cost.

YOUR NAME PRINTED IN BIG TYPE

In large prominent space, 13 inches wide, 3 inches deep, we will print your name and details of your business. Plenty of room for big type covering the facts you wish printed. Below this space is a first-class 12-sheet monthly date pad, 7 x 4 inches, dates in red and black, neat, bold lettering. The complete calendar is thus all you can desire in usefulness, handsomeness and educational value.

Patent wrappers for the calendars will be shipped you unrolled for easy addressing. Advance shipment will give you plenty of time for this. Calendars roll up in these wrappers without trouble, and have metal strips top and bottom to prevent damage. A metal ring makes hanging-up easy, and insures hanging straight and flat on the wall.

FREE OF COST, assistance will be given by correspondence to help you get together the best possible list of names to which to send your calendars. You will also receive free practical suggestions on best methods of following up your calendars to get new business.

For 365 days your advertisement will hang where your prospect will see it and refer to it. For 365 days it will remind him of you—educating him to know more about welding—suggesting to him that you are the man capable and ready to do the job.

USE ORDER BLANK ON OTHER SIDE

Your order blank is waiting on the back of this page. Don't delay entering your order. Hundreds of dollars have been invested in promoting this calendar. Except on our co-operative plan the price would be beyond anything common sense would pay. But thousands of welders will share and lower the cost. Therefore, to you, a sharer in the combined buying power of these thousands of job shops, is now available at rock bottom what we believe will prove the biggest business-pulling value a welder's money has ever been able to buy.

COMPETITORS WILL BE PROTECTED

REMEMBER—your competitor will NOT have this calendar if you have it. Arrangements, reasonable to all parties concerned, will be made in all cases where orders are received from competitors.

LIST OF THE 24 EXCLUSIVE PHOTO ILLUSTRATIONS, 47 VIEWS

Red Pointers Mark All Welder's Work. Each Picture Powerfully Effective In Forcing Your Advertising to Be Read, Believed and Acted On

AUTO CYLINDER, jacket welds; inner, outer.
HOISTING ENGINE FRAME, break and weld.
ALUMINUM CRANK CASE, broken, lost part, welded.
STEAM CYLINDER, patched break weld.
REAR AUTO AXLE HOUSING, welded, perfect alignment.
AIR COMPRESSION CYLINDER, crack cut, welded
FROST-CRACKED AUTO CYLINDERS, break and weld.
ARMATURE SHAFT, worn, built up, machined.
FORGED STEEL AXLE, break and weld.
ELECTRIC MOTOR FRAME, steel; break and weld.
ALUMINUM GEAR CASE, break and weld.
BOILER PLATE WORK, long seams, piecing.
AUTO CRANK SHAFT, break and weld.
GAS TANK, seams and pipe connections welded.
AUTO TRUCK FRAME, break and weld.
STEAM BOILER, flue sheet, welded patch.
AUTO CRANK CASE, piece broken out, weld.
CAST IRON GEAR, broken teeth, built-up, machined.
STRUCTURAL STEEL, construction welding.
ALUMINUM TRANSMISSION CASE, end-break weld.
CAST IRON PRESS CROSS-HEAD, break and weld.
AUTO TRANSMISSION CASE, side-break weld.
SECTION INSERTING, machine parts length ened by weld.
RECLAIMED STEEL CASTING, sand pocket cut out, steel block welded in.

THE WELDING PROMOTION CO

USE THIS ORDER BLANK

412 Square Inches of Indoor Billboard
Advertising You 365 Days
ON WALL SPACE NO MONEY CAN BUY
At Less Than Two and One-Half Cents a Month

To *Date* ..... *192* .....

THE WELDING PROMOTION CO
Suite 501, 574 Fifth Avenue, New York City

This is ORDER for ..... *Quantity* **Calendars at $29 per 100**

Smallest quantity which can be ordered is 100. Over this quantity, fractions or multiples of 100 charged at same rate.

Figure your list of names carefully. Order enough now. Then you will not be short when later you need extras.

I attach to this Order Blank a Separate Sheet on which is plainly written all wording I wish printed in the 13 x 3 inch space on my calendars. I also attach printed sample of my stationery for verification of spelling, etc. I am sending you by Parcel Post Special Delivery, in package marked with my name, the following cut (or cuts) which I want you to print with my name, etc. State Yes or No.....

Describe .....

☞ **Customer's Signature** .....

WRITE NAME AND ADDRESS VERY PLAINLY

Name .....

House No. ..... **Street** .....

Postoffice ..... **State** .....

25% OF TOTAL AMOUNT TO BE SENT WITH ORDER

State here amount sent herewith: $.....How sent { **P. O. Money Order** / **Express Money Order** / **Bank Check** / **Registered Letter**

PAY NO MONEY TO ANY PERSON

Please Give References:

1 .....

.....

2 .....

.....

3 .....

.....

This order is subject to approval and acceptance by The Welding Promotion Company at its home office.

In event of non-acceptance deposit sent with order will be returned together with notification of non-acceptance.

The Welding Promotion Company shall not be liable for any failure or delay or interruption in the performance of this contract caused by strikes, market conditions, whole or part shutdowns, fires, or other conditions or causes beyond our control.

Quotations are for immediate acceptance and subject to change without notice. Shortages or overruns not exceeding 12½ per cent will be accepted at the pro rata rate.

The Welding Promotion Company will not be responsible for any delay in deliveries caused by failure to furnish advertising copy or complete information for advertising copy within 10 days of the date of this order. Any delay of delivery caused by failure to furnish copy shall not alter time of payment.

All moneys owing on this order become immediately due and payable 30 days after date of shipment.

The Welding Promotion Company is to use its own discretion in selection of type and arrangement of advertising matter unless otherwise specified in this order, and will not be responsible for spelling of names, addresses, etc., unless advertising copy is accompanied by customer's printed stationery.

Any plates made by The Welding Promotion Company for use on this order are to be its property and remain in its possession, unless other disposal is hereon requested.

Promises and agreements made by salesmen will not be binding unless written in the ORIGINAL ORDER.

Salesmen have no authority to collect accounts or to incur any indebtedness on the credit of The Welding Promotion Company.

This order is not subject to cancellation. See that it contains everything that you intend.

These several conditions are equally for your protection and our own.

WHERE WE FIT IN WITH YOU

THE JOB WELDING INDUSTRY at last has its own advertising service and business promotion company through which the welder everywhere can continuously secure assistance in getting more and better orders, fortifying himself for better prosperity in 1922, and establishing a firmer business basis for the future. We hope to capably fill what is perhaps the average welding shop's very greatest need.

We follow the successful lead of many other lines of business where co-operative or "pool" advertising has given expert service at low cost to the individual who could not otherwise provide it for himself because he lacks time or experience or money.

The "Say It With Flowers" and the "Save the Surface" co-operative services increased the gross florist and paint business millions of dollars. So with the fruit and nut growers; lumber, brick, milk, burial monument dealers; dry cleaners, jewelers, laundries, etc. Costly advertising is, in each case, distributed among many users. Each user's share becomes a small, sound investment.

JOB WELDING PARTICULARLY NEEDS this sort of co-operative work. Many a welder has been held down in expanding his business because he has lacked proper means of showing what he could do except by actually doing it. He has had no good way of demonstrating in advance the variety of work his skill could undertake. He has found his shop doing a few kinds of work when it should be doing many. He has been rushed one day, and without work the next. Poor reputation has directly resulted from public misunderstanding of the work he could do if given a chance. Discouragement has taken the place of rightful prestige and prosperity.

And all this we hope to change by helping the welder, large or small, rich or poor, to make better known the tremendous importance of his work in the almost limitless variety of jobs his skill is prepared to handle.

WE INTEND to show you to be a man who wants to *serve* as well as *sell*—a man who is ready to meet a customer on his own ground, talking interestingly and helpfully about the customer's business—a man who comes to a customer not to take something *away* but to bring something *in*. We propose to advertise you as a man who can offer your customer a *service* which will help *him* with *his* problems.

By this kind of advertising your prospective customer many times is influenced to send in his orders without a call from you or your salesman. In cases where a call is necessary to close an order, many facts are already advertised and understood in advance. You are helped to get in to a show-down with your man. And, because half your story is already told, you get your necessary opportunity to present any difficult facts which require close attention and take time for the convincing proof that lands the order.

The new advertising, in wording, illustration and suitable artistic effects, will be prepared according to the highest standard of this effective Educational Argument, and will be prepared in sufficient variety to cover all necessities. Therefore from the welders themselves we must get our figures on the general requirements of the industry. If welders will promptly send careful statements regarding the type or types of welding they do, and the kind or kinds of work they specialize in, local conditions to be met, etc., this co-operation will be greatly appreciated, and will do much good. *The Band Wagon is waiting. Get Aboard!*

SEND IN YOUR NAME NOW

so that you will be sure to receive all important announcements sent to every welding shop whose name is on

OUR MAILING LIST

WELDING RODS

Parsons' Manganese Bronze Rolled Welding Rods

the Strongest Bronze Made

for high-fire Brazing and Oxy-Acetylene Welding of Malleable Iron or Bronze and Brass castings assure a faultless, flawless job. This is another example of the "Cramp" standard of quality. This scientifically perfected metal is the result of long years of experience. Its fine physical properties make it especially suitable for welding purposes.

A strong weld of fine close grain and exceedingly tough texture is always the result where Cramp's Welding Rods are usesd.

We can also furnish Welding Rods of Cramp's Cast Iron, Cramp's Copper Covered Iron, Cramp's Vanadium Steel, Cramp's Drawn Aluminum, Cramp's Cast Aluminum, Cramp's American Iron and Soft Brass Brazing Wire.

CRAMP

We furnish and will be glad to estimate on all kinds of brass and bronze castings.

The William Cramp & Sons Ship & Engine Building Co., Philadelphia

Those who have enjoyed long association with CANADIAN CARBIDE have always assumed high standards of performance We are confident that if not already among the users of CANADIAN CARBIDE the day will come when you too will know the meaning of "More Gas per Pound"

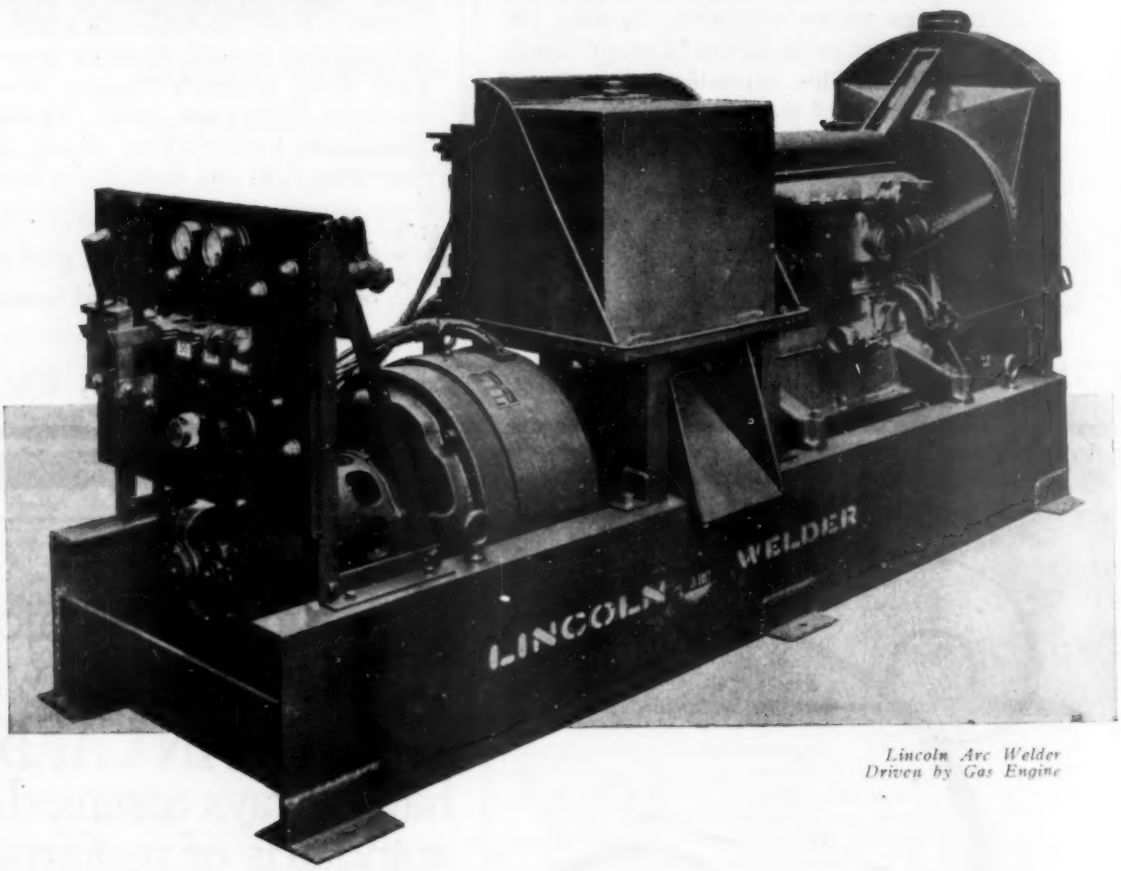
SHAWINIGAN PRODUCTS CORPORATION

110 WILLIAM STREET NEW YORK
549 McCORMICK BLDG. CHICAGO

SHAWINIGAN

LINCOLN ARC WELDER

The Commercial Welder Uses LINCOLN



Lincoln Arc Welder Driven by Gas Engine

More job welding shops use the Lincoln Welder than all other makes of electric welder combined.

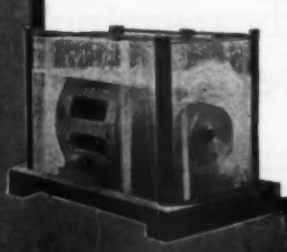
They know, because it is their business to know, that the Lincoln is the most economical to operate and will do more work per day.

They can operate the Lincoln Arc Welder satisfactorily with a gasoline engine which makes it portable for use on motor trucks, repair tugs, etc.

The Lincoln Arc Welder will weld heavy cast iron parts wherever they may be without moving them for pre-heating.

It is so flexible that it perfectly meets the job welder's requirements for electric welding equipment.

This Standard Lincoln Motor operated over 2 years under water without damage.



The Lincoln Electric Co.

General Offices and Factory, Cleveland, O.

Branch Offices in Principal Cities

The Lincoln Electric Co., of Canada, Ltd., Toronto-Montreal

You Make a "Good" Torch

—why not get the Best Regulator?

—why not?

Make it a Federal

"FEDERAL" Regulators have been passed by the National Board of Underwriters. Should a diaphragm, for any reason, become ruptured, the gas is released through special vent holes at the rear end of the front cap, absolutely preventing any possible chance of physical injury to the operator.

"FEDERAL" Regulators are made of the very best materials by expert mechanics for expert welders who know the value of and appreciate absolutely dependable Regulators.

Federal Brass Works

31st St. and Kedzie Ave. CHICAGO

Swift's Pure Oxygen

"A Reputation Imposes an Obligation"

Swift Oxygen must pass the most rigid tests —must never vary from its high quality standard.

Swift Oxygen is produced in the largest electrolytic plant in the U. S. A.—in ample quantities to render unequalled service to our customers.

The use of Swift Oxygen in your plant will aid you in raising the standard of the work of your operators.

The Name is Your Guarantee

Swift & Company,

Oxygen Department

Union Stock Yards Chicago, Ill.

Quality You Can See

WHEN you light the torch you can see the quality of COMMERCIAL Acetylene in the easily maintained neutral flame. This superior quality is found in every cylinder of COMMERCIAL Acetylene, because this gas is pure—and uniform. If you use it in your shop you can weld without worry—the flame will be right.

Also when you want to buy economically, buy acetylene the COMMERCIAL way. You buy the gas only, we loan you the cylinders.

Acetylene supplied in portable cylinders of the following sizes and capacities:

10 in.	x 30 in.	size	- 125	cu. ft.	capacity
12 "	x 36 "	"	- 225	" ft.	"
12 "	x 44 "	"	- 275	" ft.	"

Submit your acetylene requirements to our nearest office.

Commercial Acetylene Supply Co.

Main Office: 80 Broadway, New York City
542 S. Dearborn St., Chicago

Atlanta, Ga.
East Deerfield, Mass.
San Francisco, Calif.
Boston, Mass.
Bound Brook, N. J.
Aurora, Ill.
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CESCO HELMET

Door hinged at arrow, all helmets are fitted with

Essentialite Lenses

Style "P"

Sold by All the Leading Jobbers of Equipment Manufactured by

CHICAGO EYE SHIELD CO.

2300 WARREN AVE., CHICAGO, ILL.

Wanamaker Coated Electrodes

FOR ALL CLASSES OF

ARC WELDING

COATED WANAMAKER ELECTRODES

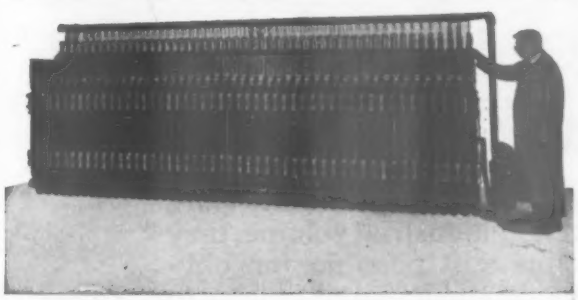
produce better welds because of their effective coating and the superior chemical analysis of the electrodes themselves. The use of these electrodes assures you of welds of maximum strength and uniform structure. The various classes have been chosen with great care by practical welding experts to meet the requirements of metal arc welding as practiced at this time.

THE TECHNICALLY CORRECT ELECTRODE

Send for the new Tecor Specialties Bulletin describing the Wanamaker Coated Electrodes and also a complete line of Welding Accessories.

Transportation Engineering Corporation

200 FIFTH AVE., NEW YORK N. Y.
608 SOUTH DEARBORN ST., CHICAGO, ILL.



THE PUREST OXYGEN

SAVES MONEY
SAVES TIME
Does Better Work

GAS CONSUMERS MUST CONSIDER

EFFICIENCY in cutting and welding operations
ECONOMY in the application
QUALITY in the finished work

Pure *Oxygen* and Pure *Hydrogen* as produced by the *I. O. C. System* are VITAL FACTORS in such considerations. Over a score of *I. O. C. System Commercial Plants* are ready to supply your requirements from the following points:

Atlanta, Ga.	Indianapolis, Ind.	Pittsburgh
Boston	Louisville, Ky.	Portland, Ore.
Buffalo	Hoboken, N. J.	Salt Lake City
Chicago	Kenosha, Wis.	Tariffville, Conn.
Cleveland	Newark, N. J.	Toledo, Ohio
College Point, N. Y.	New York City	Washington
Dayton, Ohio	Omaha, Nebr.	Youngstown, Ohio
Davenport, Ia.	Peoria, Ill.	

International Oxygen Co.

Newark, New Jersey

London **New York** **Paris**

N BRAND **Wire Silver Solder** BEST ON EARTH

Used for Welding and Brazing

"NOBLE" Silver Solder Makes a Perfect Weld of the Broken Parts

Sold in 1-Ounce Bundles

Any Size or Thickness.

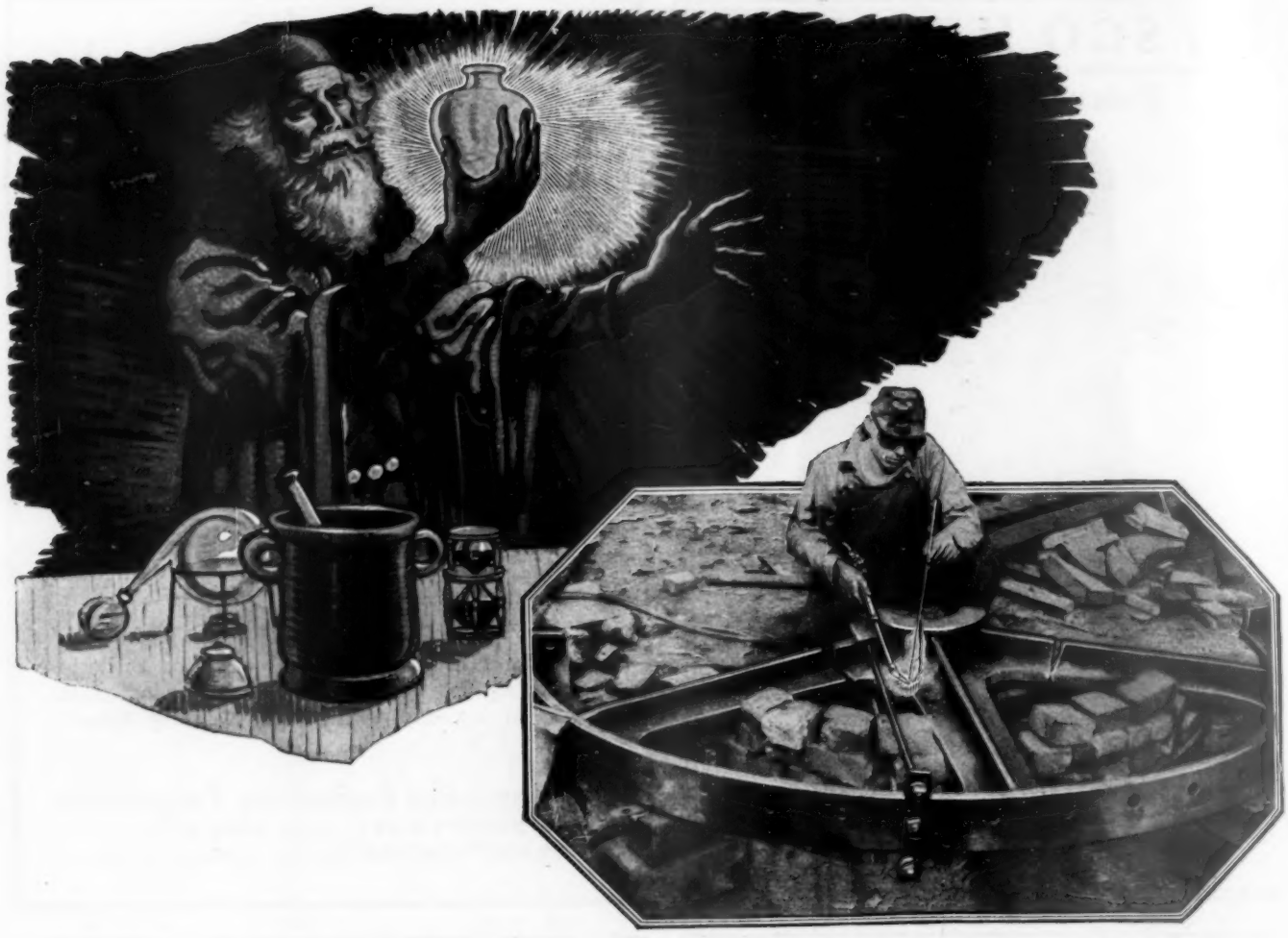
Sold in Sheet Form, Wire Coils and on Spools for Welding or Brazing Steel, Copper, Brass, and Nickel Silver.

MADE IN FIVE DIFFERENT QUALITIES. OUR NO. 8 QUALITY IS INEXPENSIVE AND USED EXTENSIVELY BY WELDING CONCERNS.

Inquiries Appreciated—Samples Furnished Upon Request

F. H. NOBLE & CO. CHICAGO, ILL.

555 W. 59th ST.



The age-old dream of the alchemist is realized because of Linde

THROUGH countless centuries man dreamed of transmuting the baser metals into gold. Patiently, laboriously, often consecrating their very lives to the work, the Alchemists of old toiled on toward their elusive goal.

As late as 1873 James Price, the last of the Alchemists, sought death by his own hand rather than acknowledge the failure of his experiments.

Linde Engineers of to-day have made this dream of by-gone ages come true.

By producing uniformly pure oxygen in industrial volume, they have made it possible for oxy-acetylene welders and cutters to reclaim thousands of tons of metal machinery annually—turning base metal into gold—a saving in money far in excess of any vision of wealth dreamed of by ancient philosophers.

And Linde does more than supply oxygen of absolutely uniform purity. Thanks to a chain of twenty-nine plants and forty-six warehouses it delivers Linde Oxygen when and where it is wanted in any volume.

THE LINDE AIR PRODUCTS COMPANY
Carbide and Carbon Building, 30 East 42nd Street, New York
Balfour Building, San Francisco

THE LARGEST PRODUCER OF OXYGEN IN THE WORLD

L-500-21

AUTOGENOUS PIPE WELDING*

Some Tests on Welded Pipe Construction—Results Show That Welded Joints Have Several Distinct Advantages

By H. B. Iglehart

THE welding of non-fired pressure vessels, though it is practiced to a very considerable extent, seems to be somewhat shrouded in mystery. A clear understanding of its great advantages is not at all general, even in the engineering profession. The most important parts of non-fired pressure vessels are the piping and fixtures, inclusive of connecting joints. Referring to the construction of such parts, one frequently hears engineers say that this, that or the other pipe must not have any welds. They are never able to give any satisfactory reasons for their views. Their answer, in every case, is equivalent to a plain "because"! This lack of understanding is very largely due to the fact that welding engineers and manufacturers of welding equipment have not given the subject of pipe welding sufficient publicity to acquaint potential users with the possible applications of the

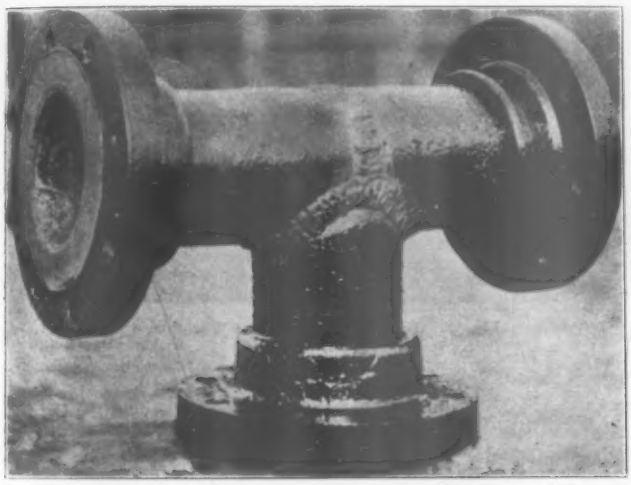


Fig. 1. An Example of Heavy Pipe Welding

process and with approved practices in fabrication and installation.

There are still many who look on a weld in a pipe line as a patch, yet who would not hesitate to insert a pair of screwed flanges with gasket and bolts at the very point where welding is unwelcome. The flanged connection certainly has no higher strength efficiency than the welded joint, and it costs more to install, more to cover, and will ultimately prove a source of overtime for repairs which, in some instances, may require shutting down of the plant during busy periods. It is obvious, therefore, that the welded joint is more desirable in these respects, and I may add that it contributes to greater general safety.

There are several operations in pipe welding for which there should be specially designed machines. In acetylene cutting, for example, a machine operated blowpipe can be used much more economically than the hand cutting torch because of its greater speed, both actually and compared to the volume of gases consumed. The machine operated blowpipe also admits of far greater accuracy, thus reducing setting-up operations to a minimum and contributing to faster and better welding. The development of special machines should receive the united attention of oxy-acetylene welding instrument designers, machine builders, engineers and pipe fabricators, for the purpose of bringing forth new and better mechanisms and appliances as rapidly as possible.

Paper read before the International Acetylene Association, New York, Oct. 5, 1921.

Pipe Welding.

We will now take up a comparison of a plain butt weld and a regularly flanged joint. (See Fig. 10.) The flanges

Fig. 2. Test Pieces of Welded Pipe

may be counterbored and peened; they may be rolled or expanded type, plain like a boiler tube or with grooves turned in the flanges; they may be threaded only or threaded and peened, or of various other types, any of which forms can use rolled steel or cast iron flanges on steel pipe, but a lot of bolts and a gasket are required to complete what when finished can only be a temporary splice, as everyone knows of the expense and exasperation of maintaining gasket joints. The welded joint, when properly made, is neat appearing, is as durable as the pipe itself, does not interfere with hot or cold insulation and will not require any attention during the entire life of the pipe line, as a good weld does not deteriorate

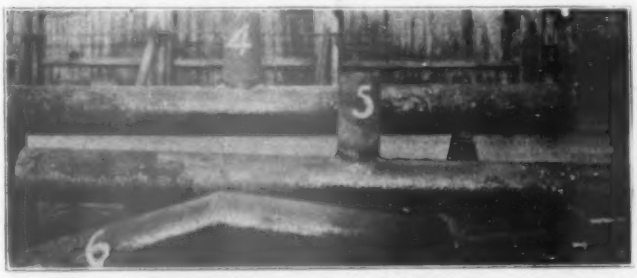


Fig. 3. Six-Inch Neck Welded in Eight-Inch Pipe

any faster than the parent metal. To make such a weld properly the ends of the pipe should be chamfered at an angle of 45 degrees and be placed in line with the tips not less than one-sixteenth of an inch apart in order that thorough penetration may be had to the inside of the pipe, which must be religiously done in all cases if the 100 per cent mark of strength efficiency is expected. The welding rod or wire should be of as near the same carbon content as material in pipe as can ordinarily be had. Much depends on the welder, as no carelessness or guessing must be done in regulating flame of torch. The weld should be built up as rapidly as the molten metal can be handled without overlapping and

in a continuous operation all around the pipe. If the welding flame is slowly moved over the first part welded for a few inches, the weld is automatically and homogeneously annealed for all practical purposes.

After completion of weld a hydrostatic test should be applied to at least double the working pressure to be carried. While the pressure is on an impact and vibration test should be added by free use of a medium hand hammer in striking

Fig. 4. This Would Stand a Water Pressure of 500 Pounds

sharp blows all around the pipe on each side of, close to but not on the weld. That will show up porosity or cold shorts, by removing the small particles of oxide which in many cases temporarily prevent leaks from showing up during tests in which vibration is not applied. The idea of not hammering directly on the weld is that in doing so it sometimes happens that a thin shell is forged over small leaks which will soon corrode away when the weld is in use and then a leak gives another black mark against welding, although it should be charged to the method of testing instead of to the welding profession.

A comparison of a welded neck or branch line, as from a header, and a regularly flanged tee with its gasket joints is not necessary, as any one can readily see. Regarding the welded neck or branch line (See plate 11) the operation requires a male and female cut, both of which should be ma-

Fig. 5. Showing Strength of Welded Joint

chine made when a machine can be built. The hole should be cut at a good wide angle in order to form a good groove for the weld. The neck or branch must be cut so that it will conform to the inner contour of the main or header. The end of the neck or branch line will not require any bevel or chamfer at its short points, as there it goes through the other pipe, but at its long points it much meet the inner and outer face of main, therefore will have to be chamfered fully at those points, gradually lessening towards the short points. This would not be the case if the neck or branch is of smaller diameter than the main or header, as you can note by reference to Fig. 11 or Fig. 12, the smaller the branch compared with the main the shorter will be the ends on the neck and less bevel at the long points.

Fig. 6. Pipe Bent and Tested with 750 Pounds Pressure

Note that the hole must be cut so that when set up ready to weld there is the required one-sixteenth inch clearance at all points, points AA included. In welding it is, of course, impossible to make a thorough amalgamation with all of the fibre layers or courses of the neck or branch at points AA. Extra strength must be added by building up the weld to

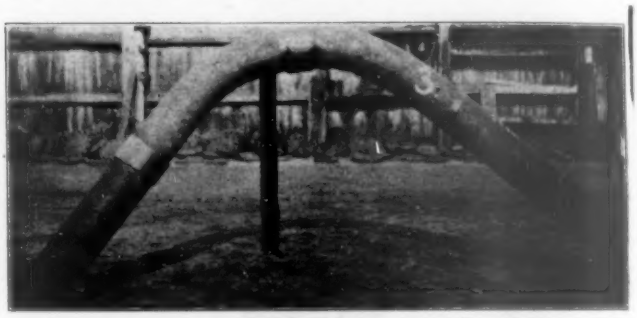


Fig. 7. Bend Test on Piece Number 3

form a good fillet to a radius of about twice the thickness of the pipe. I have been referring to a 90 degree branch, but, except for the shape of cuts, it all applies to any angle branch line or neck. A neck should never be welded on and then have center cut out afterwards unless it is short and of not less than 14 inches diameter, so that the end can be welded over after the cutting has been done; otherwise the weld will

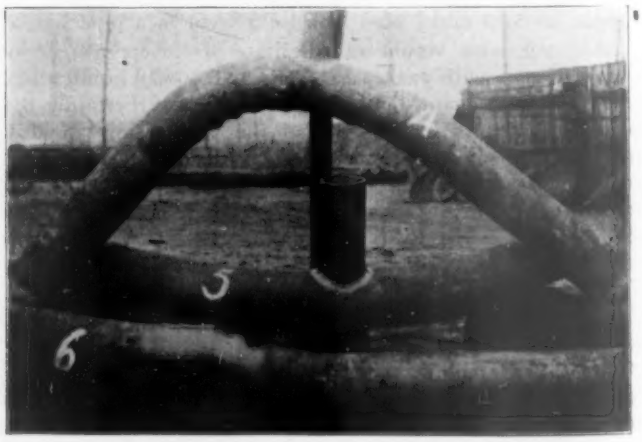


Fig. 8. Severe Test on Piece No. 4, Fig. 3

be a poor one and have a low efficiency. The testing of such welds, or in fact any pipe welds, should be as described for plain butt welds.

Very frequently flanges should be and are welded on necks, branch lines and main lines and headers. Sometimes screwed flanges are used and simply welded on the back as a sure seal,

but usually they are of the rolled steel hub, or ring types (See Fig. 13). The sketch shows a ring welding flange which is prepared by boring to exact size of outside of pipe and then chamfering each side to a 45 degree angle to center. They are welded with a small fillet on the pipe side and

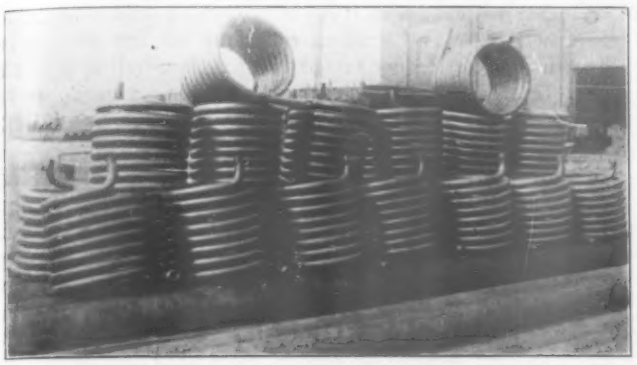


Fig. 9. Fuel Oil Heater Coils

straight on the face side, allowance being made to reface the entire flange after welding and before testing.

Hub welding flanges (See Fig. 14) simply have a hub forged to practically same inner and outer diameters of the pipe; the end of the hubs are chamfered, thus the weld becomes a regular plain butt weld and is treated the same in every way.

Quite often the end of a pipe is to be closed with a welded plug or cap, as it might be called. (See Fig. 14.) The pic-

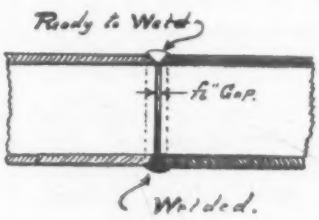


Fig. 10. Plain Butt Weld on Pipe Line

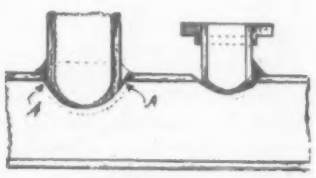


Fig. 11. Design for Welding Branch Lines

ture shows the best form of getting the most strength at reasonable cost in sizes up to 6 or 7 inches, provided, of course, the pressure to be carried is not too high, in which case it would be necessary to dish the cap. In some cases it is found better to make the cap flanges as shown for Cylinder Head in Fig. 15. The size of the pipe and the pressure to be carried have to be the governing factors in deciding the best and most suitable form for this work, as some cases require a cap or plug to be both dished and flanged, as shown in Fig. 16.

flanged heads now in use, some of them being on very high pressure and high temperature work.

There are many people even in these modern times who will say "a welded pipe is all right if one only could be sure it is strong enough to be safe." I pity their mental condition. We cannot well afford to break everything to pieces to ascertain its strength. We have the same methods and ways of testing the strength of a pipe weld as of any other article made by welding or otherwise. To substantiate these statements, I will describe some parts of a series of research operations carried out in the shops of the W. K. Mitchell Company in Philadelphia, this year for the purpose of demonstrating and illustrating that welded pipe joints are strong when properly made. Early in the year the Power Piping Society requested the W. K. Mitchell Company to supply it

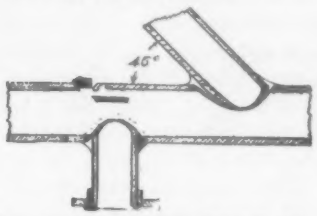


Fig. 12. A Smaller Branch Requires Shorter Ends on the Neck

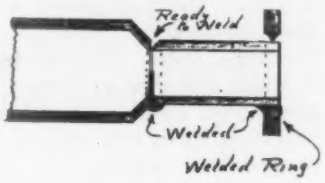


Fig. 13. Preparation of Ring Welding Flange

with some data on tensile strength tests of welded joints. Quite a long series of tests was made. Following are condensed memoranda of the findings:

All specimens were cut from a length of 8-inch, 28½ lb. steel pipe. They were cut 13 inches long and two and one-quarter inches wide, and milled down in center to about 1½ inches in width for a clear length of six inches. A greater length could not be used in the machine at that time, but, of course, a 17-inch length would give greater accuracy in yield points and elongation.

The longitudinal strips without any welds averaged 57,625 pounds tensile strength. The longitudinal strips were not flattened except at extreme ends for grip of testing machine. This flattening was done under steam hammer, cold. Longitudinal strips with oxy-acetylene welds in center averaged 55,895 lbs. breaking strength, or an efficiency of 97 per cent. Longitudinal strips with D. C. Electric welds in center averaged only 44,245 pounds, being an efficiency of 76 per cent, the broken welds showing porosity and crystallization, a poor grade of welding wire having been used by mistake. The longitudinal strips were welded before being cut up into the 2¼" strips. Circumferential strips were welded after being cut off and straightened. The straightening was done

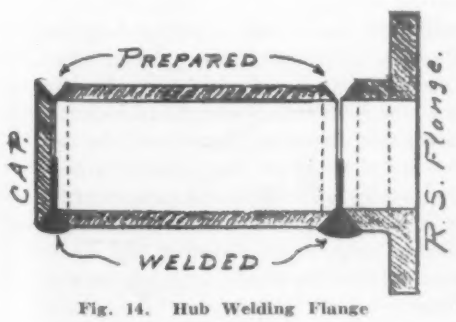


Fig. 14. Hub Welding Flange

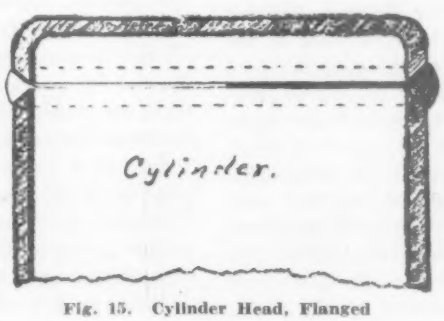


Fig. 15. Cylinder Head, Flanged

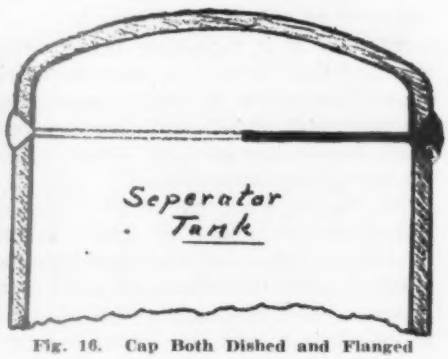


Fig. 16. Cap Both Dished and Flanged

A welded separator or receiver head is by far the most serviceable when done as illustrated in Fig. 16. Steam separators are subject to sudden and frequent changes of temperature, causing terrific strains and stresses, with the result that riveted and caulked heads soon get to leaking in the joints and around rivets. The writer has had this very forcibly driven into memory by several severe experiences, which fact makes it a joy to say that no leaks or trouble of any kind have arisen from the numerous welded dished and

by slow pressure, the strip being heated to a dull red. Circumferential strips free of any welds or joints averaged 59,125 pounds tensile strength. Circumferential strips with the regular mill lap in center averaged a breaking strength of 57,975 pounds, an efficiency of 98 per cent. Circumferential strips with oxy-acetylene welds in center averaged 58,385 pounds, or an efficiency of 99 per cent. The circumferential strips with D. C. Electric welds in center averaged 54,515 pounds, being an efficiency of 92 per cent. All welds were

made from outside of pipe only, as would be done in regular practice. You no doubt will have noted that the circumferential strips averaged about 4½ per cent stronger than the longitudinal specimens. Possibly the heating for straightening affected it some. That is a metallurgical question rather than one of welding.

For the sake of complete information, a few specimens were welded from both inside and outside. The breaking of them showed no gain at all in the strength, which proved that the pipe welded from outside only secures all of the obtainable strength. Many of the previously mentioned breaking tests did not break in the weld or close to it, which shows they often reach the full 100 per cent mark.

A few months ago a number of practical demonstrations of strength of welded pipe joints were made under the direction of the writer at the W. K. Mitchell Company Shops in Philadelphia. The test pieces were later cut into sections for close examination and are still on exhibition at the Mitchell Company offices. Photographs were taken at the time, some of which will now be shown. (See Fig. 2.) Piece No. 1 is a 6-inch pipe, about six feet long, with two four-inch branches welded in. The one marked "old" was a rusty piece, the one marked "new" was free of rust. They were on exact opposite sides of the 6-inch pipe and about three feet apart. The six-inch pipe was clamped to a bending table, two eye-bolts attached to the branches, and they were then pulled up by use of a crane, no filling being in pipes. The old one cracked at an angle of 30 degrees (See Fig. 4); the new one developed a small crack on back at angle of 47 degrees. The cracks are about 1½ inches long. The old one went through at one point; the new one goes only one-third the way through. The sections of this weld show it would not have leaked with a water pressure of 500 pounds per sq. in. See Fig. 4, then Fig. 5, and note how the six-inch pipe was crushed, giving indisputable proof of the great strength of acetylene welded pipe joints. No heat was used when pulling.

See Fig. 2. Piece number 2 is a regular butt weld in seven feet of 8-inch F. W. Pipe. This was sand filled and regularly bent hot to a radius of 30 inches, then flanged and tested with 750 lbs. hydrostatic pressure. No leaks or any signs of distress appeared. See Fig. 6.

Again refer to Fig. 2 and note Piece 3, which is made of four pieces of 8" F. W. pipe, with a flush butt weld in center having a bored-out coupling slipped over it and welded at its ends. To the left is a regular threaded joint, with several reinforcing welded tacks. To the right is a regular butt weld. This was sand filled and "regular bent" hot on a thirty-inch radius. See Fig. 7. The two outer welds were cut away and the remainder of the bend flanged and tested to 750 lbs. cold water pressure. No leaks or defects appeared, but, even so, this form of joint is not generally to be recommended as it is expensive, being virtually three welds for one; and then there is an element of risk, by reason of the unavoidable strain of unequal expansion of the pipe between the two welds and the coupling or sleeve, as the sleeve is of much larger diameter and would have a much lower temperature in any steam line.

See Fig. 3. Piece No. 4 is 7½ feet of 8" F. W. Pipe with a six-inch neck welded in. This was filled and bent hot on a thirty inch radius, the neck being on the outside of the bend, causing a fearful strain on all parts of the welded joint. No rupture occurred, simply a slight elongation of the lower end of the six-inch neck, due to the natural stretch of the 8", as you will note in Fig. 8.

In Fig. 3, piece No. 5 is the same as No. 4, and was treated the same, except that in bending the neck was kept on the side, as shown in Fig. 8.

Again referring to Fig. 3, article No. 6 is made of two pieces of 8" F. W. pipe welded together at an angle of 30 degrees. This was filled with sand and bent back against itself hot. Note that both parts of the pipe show a decided radius, but the weld is still intact in every way, as shown in Fig. 8. None of the welds in Fig. 8 have any practical value in regular practice, but they do very forcibly show acetylene welded pipe joints to be as strong as the parent material.

Fig. 9 shows a group of Fuel Oil Heater Coils for Steam Ship Ballast Tanks or Special Oil Tank Steamers. They are of two-inch extra heavy pipe. Each coil has fifty-one feet, four inches of pipe, with from two to three butt welds, made before bending. The bending was done hot but without any filling in pipe. All were tested to three hundred pounds cold water pressure without a break. In bending a group of 100, only one weld cracked in the bending, and that, being on the outside, was easily repaired.

In conclusion I will say it is well to bear in mind that Pipe Welding requires faithful attention on the part of the Welder. All welders are not pipe welders. There is need of much training to take care of the special conditions encountered. It is interesting work, and most good welders who take it up seem to like it as soon as they have been associated with it long enough to get familiar with the exacting requirements. This is another item to be kept in mind as a part of the necessary research work by the Welding Engineers to broaden the scope of practical uses of pipe welding.

Written by H. B. Iglehart.

A NATIONAL SURVEY OF INFORMATION SOURCES

Evidence that technical and business executive are realizing more and more the importance of facts and information is presented in the "Special Libraries Directory," recently published by the Special Libraries Association. In his introduction to this volume, Dorsey W. Hyde, Jr., president of the Association, points out that there are more than 1,300 special libraries in the United States and that this number is rapidly increasing.

The research, industrial and engineering libraries included in the Directory cover a wide variety of subjects. There are listed, for example, special collections on Engineering, Technology, Electricity, Chemistry, Public Utilities, Railroads, Industrial Management, etc. The subject index brings out even finer points, such as Climatology, Motion Pictures, Patents, Photography, Safety, Steel, Telephones, Weights and Measures, and Welding.

Some of the engineering libraries report interesting special features. For example, the Boston Society of Engineers has a collection of books "written by engineers on other than engineering subjects." The library of a professional engineering firm reports a collection of from 100,000 to 200,000 trade catalogues covering a wide range of industries. One university library possesses 4,200 lantern slides on engineering subjects. Many of the engineering libraries have given special attention during the last few years to the collection of military, naval, and aviation engineering literature.

The complete findings of the Special Libraries Association's survey have recently been published in the form of a national Special Libraries Directory, copies of which may be obtained from the Association, 3363 Sixteenth Street, Washington, D. C. In so far as is known, this Directory represents the first attempt at a comprehensive study of the special information sources of the United States. In addition to engineering, the Directory furnishes a key to special sources of information on such widely differing subjects as Taxation and Theology, Astronomy and Automobiles, Dyestuffs and Diplomacy, and Folklore and Furniture.

WHARTON ISSUES STOCK BULLETIN

Stock Bulletin No. 2, issued November 1st by William Wharton, Jr., & Co., Inc., of Easton, Pa., lists 811 oxygen cylinders, ranging in capacity from 10 cu. ft. to 175 cu. ft. 810 carbonic acid cylinders of twenty pounds capacity and 464 chlorine cylinders with capacities from ten pounds to 150 pounds. These are all new cylinders, with standard malleable iron caps, all meeting the I. C. C. tests and specifications.

WHY ONE TORCH WENT OUT

The Story of Torch Which Received the Blame for the Operator's Carelessness

EVERY welder has wondered at some time or another, just why his pet torch suddenly ceased working right when after a long period it had been giving first class service. And why, oh why, should that last fatal splutter and weak little whistling blue flame have occurred? While thus he ponders and questions the general scheme of things, a little practical consideration of the situation might help some.

A service man travelling in the central west for a reliable equipment concern sat in a comfortable seat in the lobby of a hotel. While thus comfortably ensconsed and deeply interested in a local newspaper, he was gruffly notified by the bell boy of a telegram that had just arrived for him. Languidly he opened it and read. It was the usual dictum from the sales manager to hurry to a concern in the territory that he covered and make certain repairs. People generally hurry when under the stress of telegraphic orders and so this repairman shook out of his lethargy and hustled into his overcoat. Aboard the train an hour later, he began to wonder what the trouble could be for the telegram mentioned a torch difficulty. The town soon came into view and Mr. Service Man hopped off at the station and made a run for the scene of trouble.

The office of the plant to which he was directed was far from the street and hard to find. The reception committee in the office was the plant engineer and there was a warm reception awaiting the equipment company representative. Of course it was not the warmth of a loving mother greeting a long lost son. It was a warm one with most of the heat under the collar of Mr. Plant Engineer.

A verbal explosion followed the meeting in which the repairman felt as if he and his whole concern were "blowed up," for the engineer shot out some powerful language to the everlasting discredit of all things connected with that equipment concern. The torch was no good. He had several reasons and proofs for that. The company was no good and he gave the faulty torch as the reason for that. But Mr. Service Man was not standing there for a browbeating and forthwith, he began to ask some questions.

"What sort of a torch have you?" he asked.

"A cutting torch," he returned.

"May I see it?" asked the service man.

"You may," testily replied the engineer and he led a brisk march to the workroom of the plant.

Here the repairman was introduced to a man who had less to say along the line of discredit of the equipment and the concern behind it and more about the actions of the torch. With this sort of change, the light began sweetly to break over the ruffled service man and when finally alone with the new party things began to develop.

"What happened to the torch?" asked the service man of his new companion.

"Why, she plugged up in here" (pointing to the elbow where the horizontal gas draft takes the downward turn for emission from the nozzle), "and we had to drill it out," he explained.

The elbow had been drilled and tapped for a tiny screw, the latter to serve as a gas blockade after the hole had served as a means of ingress to the matter blocking the elbow. Through this hole, according to the statement of the man, a small, hard, black lump was chiseled out. Such a lump was indeed quite a new thing to that repairman and it may safely be said for most repairmen, for it was indeed a new occurrence. It required more study before the fault could be permanently remedied, so the investigation continued. By this time the service man had been left to himself as his late companion was the foreman of the shop and had been called to another part for consideration of a plant problem.

The operator, a native of sunny Italy, next made his appearance and upon him a shower of questions was rained.

"What did you wrap this acetylene hose with tape for?" asked the service man.

"He leak all over—lots small holes," answered the operator.

"What made it leak like that?" asked the service man again, for the hose was not wrapped over its entire length.

"I dunno," came the reply, "I light him, he shoot hard and torch he no work no good no more, just little fire, small heat can nothing work alright."

"Then what did you do?" asked the service man.

"I shut him off. Put 'cuttlene' hose on here and turn him on lots'e pressure. I teenk he blow him out pipe alright," continued the operator.

"Did it work alright then?" queried the repairman.

"Nope, next time no small fire, no heat, no nothing," returned the operator, "we drill him out then, take out black piece, put him in plug, wrap up hose with tape an' next time go all right."

The torch had been drilled and that ended the repairs as far as that repairman and that concern was concerned. The plug used was not incorporated in the original design and the people who made the repair were working on their own hook on that torch in the future.

On his way through the office, the repairman recommended that the company buy a new torch as the usefulness of the old one was doubtful. The conversation went a little further at this point, however, for the problem of the hard, black lump in the torch elbow was not yet solved.

"Did you ever notice that torch pop out when the operator placed the nozzle too deep in the hot metal?" asked the repairman of the now collected plant engineer.

"No," returned the latter, "but I have seen the operator cutting away and someone behind him attracted his attention, whereupon he turned around. After a sharp backfire and a continued sputtering of the torch the operator turned around to find his torch welded nose downward into the molten metal."

Then 2 and 2 began to make four for the repairman for this is what really happened. When the torch welded into the metal, a back fire occurred into the acetylene line not quite back to the regulator. This was indicated by the distance over which the leaky hose was wound with tape. Then the nature of the leaks, being of pinhole, rather than snags, indicated that the backfire had picked the rubber from the hose lining in millions of places. After lighting, the torch had failed to give service as was pointed out in the conversation between the operator and the service man previously. Of course it could not give service under such circumstances. Then to clean out the sputtering pipe, the foxy operator attached the acetylene hose to the torch and opened the tank valve. The terrific pressure thus pushed into the line, picked up the tiny globes of rubber burned from the inside of the hose and rushed them downward through the line till they stopped, a tight ball in the elbow. The more pressure they were given the harder they got until they were chiseled out through an improvised aperture.

WELDING SPRINGS

An Old Hand at the Welding Game Straightens Out a Few of the Kinks in This Problem

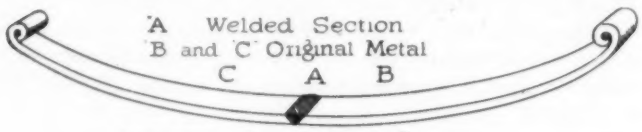
En Route, Kansas City-Denver, Tuesday.

Dear Ed:—

Suppose you'll think I've gone sort of nutty on the writing proposition, having written you only yesterday but I had rather an interesting experience on the train today and as there's absolutely not another thing to do on board I figured I might just as well jot it down now before I forget it. This isn't the smoothest running train in the world so you may have to sort of stand on your head to read some parts of this epistle but if you're game so am I.

This morning I was up in the smoker drawing on a fag when I got acquainted with a Denver man and it turned out after a bit that he was an old hand at this welding game. He was well up in years and appealed to me on account of his broad-minded way of looking at things. He didn't pretend to be the first to introduce welding in this country, neither did he know all there was to know about this subject, which you'll grant is the exception rather than the rule.

Now I have had one subject under my bonnet for quite a while thinking that I'd spring it on the right man at the



Welded Leaf Spring

A Spring Leaf Must Be Welded from One Side Only

opportune time. That particular subject was the welding of springs. From personal observation and contact with the trade I know of no other thing that is causing so much grief and trouble in the job shop as the attempts at spring welding. To my oft repeated query as to what success this kind of welding is giving, invariably the answer comes back, "Having no trouble at all. We have been welding them for years." As a matter of fact, Ed, I've never seen a spring successfully welded with the oxy-acetylene flame, so always had my misgivings whenever I heard fellows talk like that. Accordingly I made up my mind, as I just mentioned, to get an honest expression from some broad-minded welder at the earliest opportunity so I asked my Denver friend about it and feel very confident that you will be interested in learning his views.

"Spring welding," he said, "is only one of the many instances that show that the welder does very little thinking for himself. I have come in contact with tradesmen of many different crafts but never have I seen anybody use their brains less than the average welder, and of all men he should be the one that excels in that line because in the job shop practically every piece that comes in has to be handled entirely different from the next. The really successful welder you will always find with a little brain-plant all his own and its his head-work, used in combination with the torch, that makes him a success. However, this welding process, while it has a very wide application, has its limitations like everything else. Granting that new fields of endeavor are opening up before it continually, still it has its limitations and the welder certainly ought to know some of these in order to be correctly guided and not continue to give the process as a whole a black eye, as somebody once said, because of ignorant and faulty applications."

"You have mentioned springs," he continued, "so let us stick to that subject for the time being. Do you know, I've seen many a shop where they were welding leaf springs with ordinary Norway filler-rods and thought they were 'getting by.' Now, anybody who has had any experience with springs at all, knows that they must possess a uniform hardness or they are useless as springs."

"Have you a slip of paper? The back of an envelope or anything will do; I just want to make a little sketch to bring out my point."

I handed him one of my cards and he said that it would do nicely.

"Let us call this a spring with the break in the middle. All right, weld it with Norway iron and indicate the weld by the letter (A) and the original metal on each side by (B) and (C). Now, will you kindly tell me how any man, in his right mind, can figure out that (A) will possess the same hardening properties as the adjacent metal? It can't be done. Norway iron is used for welding because of its low carbon content and freedom from alloys. It does not have any hardening qualities and if we put such a repair job back in service, we find that the weld has no evidence of spring qualities and after being bent back and forth a few times it will break."

"What's the matter with using a filler-rod that will take a hardening?" I ventured.

"That's getting close to it," he replied, "but most of the welders who try that, run to the other extreme and use a high carbon rod that takes a greater hardness than the balance of the spring and naturally it breaks in the weld upon being called upon to function as a spring."

"Springs are funny things," he went on, "they all vary so much. It wouldn't be half bad if they were all the same; we'd merely figure out a filler-rod to take the same temper, after being worked by the flame, and all would be well. As things stand even the products of each factory vary to a wide degree, which makes it rather a hard problem to solve."

"There exists another very important feature which we can not overlook. A gas weld is a casting at best, and if used to unite two sections of rolled stock, such as we have in a spring, it will not be as strong because the grain of the weld will be very coarse, whereas the adjacent stock having been rolled, will be very compressed and show a very small close grain, if it can be so called."

"Judging from what you say I'd imagine that your advice to the average welder would then be to let spring welding alone," I remarked.

"You said it," he replied, "that's my advice every time."

"Evidently you consider spring welding as impossible."

"Far be it from such!" he exclaimed, "not impossible; simply a very much misunderstood operation. Personally, I've welded a great many springs and for the most part they have turned out very satisfactory. I'll admit that I've had a few failures but if you bat nine out of every ten its a pretty fair average when you're dealing with springs and their peculiarities."

"Considering the miserable failures I've seen, that certainly sounds like a pretty good record," I agreed. "Let's hear how you do it."

"Really, there isn't must to tell. You see I put in my time as a blacksmith and we used to weld springs in the forge. On account of upsetting the ends when scarfing, preparatory to welding, our springs would always come out a little shorter than they were originally. This made it extremely bad in some instances so when gas welding became popular I decided that I was going to stay with it until I could weld springs just as good as in the forge and make them come

out the same length. I spent considerable time after hours, working this thing out, and finally discovered that if I got hold of a high carbon steel rod which, when heated to a red heat and then cooled in water, would be hardened and if laid over the edge of an anvil and struck with a hammer would snap off with a peculiar ringing sound, that was the rod to use as a filler. To make a weld with this kind of a rod is quite difficult. A very soft neutral flame must be used and the rod introduced behind the flame rather than before it, in order to avoid burning. A spring leaf must be welded from one side only and a slight re-enforcement made. The weld is allowed to set an instant and then it's forged with a hand hammer to close up the grain. As the red heat changes to a blue the forging is stopped and the spring is immersed in water that has a little fish oil floating on the surface. This method, as I have said, has given me very good results but it's like everything else, requires a little practice to get it down right. Certainly springs can be welded!"

That's all for this time, Ed, but take it from "yours truly" that it's sure a pleasure to catch up with a real red blooded man that isn't afraid to part with a little of his knowledge to help the other fellow.

Will try and write you from Denver.

So long.

Shep.

SAVING BY ARC WELDING IN OIL STORAGE TANK CONSTRUCTION.

By

Edmund Vom Steeg.*

During the years of development and growth of the oil industry, enormous sums have been spent in the design and construction of expensive plants and machinery to recover small percentages of lighter grade oils from crude petroleum. One defect which, generally, has not been successfully overcome is the construction of tight storage tanks, with the result that a large percentage of their contents are lost through leakage or seepage.

Recent tests on tanks constructed by the process of electric arc welding have brought out certain interesting points which serve to illustrate in a striking manner the advantages of this method of construction over the customary methods of riveting. To take a specific instance, a five hundred barrel tank, arc welded throughout, was filled with kerosene on completion, and upon inspection at the end of seven months, was found to be without leak or sweat of any kind.

The advantages of the arc welded tank, however, are not confined to the matter of savings through stopping leakage, although that is the most important. They are cheaper to build, and as nearly as can be determined, should last longer, and cost less to maintain.

Consider the comparative cost, both in time and money, necessary to construct both types of tank. With the riveted tank, before construction work is begun, it is necessary to make templates, mark, punch and ream the plates. It is also important that the edges of the plates be faired, and that the size of the sheets be accurate. In erecting the tank it is often necessary to drift, and the plates must be drawn up tight for riveting.

The riveted construction also necessitates many joints, with angles, gusset plates, etc., and the joints must be single, double, or triple riveted, and butt strapped as the load may require, while the load requires that all holes and joints must be caulked. The usual method is to construct the bottom and first courses on horses, and, after testing, to lower the finished portion into final position on the foundation. The result is a tank whose tendency to leak is in direct proportion to the number of rivet holes and joints, added to which, wind pressure, filling and emptying the tanks, and temperature changes causing breathing or corrosion from acid in the oil are all likely to cause leakage.

Contrasted to this, the method of constructing the arc welded tank is comparatively simple, and the results are said to be superior. Although the method of assembly is practically the same, much of the preparation of the plates is unnecessary. Boring rivet holes, gusset plates, angle irons, and the fairing of the plates is for example eliminated, and the plates do not have to be fabricated except in so far as rolling is concerned. Furthermore, as lap welded joints are of 100% strength, the plates in the shell can be lightened 115%, and still leave the structure from 10 to 20% stronger than the riveted tank.

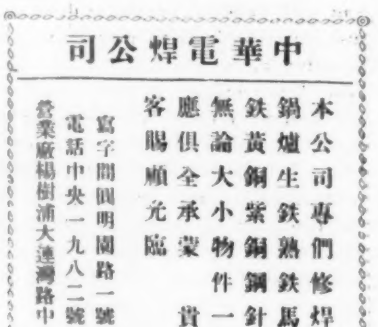
The test of any tank is its performance under service conditions and, while it will be some time before all the advantages of the welded construction can be fully determined, there are some which are apparent now. In the matter of leakage, it has been found that the principal places where leaks occur in the riveted tanks are around the rivet holes, and in the caulked joints. The former is due to the fact that when the skin of the metal is broken, the metal is subject to quick deterioration, with resultant leaks, and in the latter case caulked joints are often strained when the tank is placed in position, causing them to leak. With the arc welded tank, however, the skin of the metal is never broken, and the joints are homogenous, therefore there is no leakage from either cause. The life of a welded tank may be safely estimated at twice that of a riveted one, and it will not lose 2% of its value every year in oil, as is the case with riveted types. The saving in crude oil over a number of years by the use of these absolutely tight tanks should amount to a large sum. The savings in volatile liquids from evaporation, seepage, and leakage can hardly be estimated, as well as the savings of insurance on gas tight tanks. Over a period of twenty years, which is the estimated life of a tank, these savings should run into large sums of money.

Power and Mining Dept., General Electric Co.

CHINA HAS ITS WELDING JOURNAL

On Yuen Ming Yuen Road, Shanghai, China, the oxy-acetylene, electric arc, and thermit welding processes can be seen any working day. The China Oxy-acetylene Welding Works makes a specialty of doing everything in the welding line. They even publish an interesting, newsy bulletin, telling about the advantages and possibilities of welding in general, and about their own work. These bulletins are usually well illustrated by photographs of a variety of welding jobs. Bulletin No. 5, issued in August of this year, was an eight-page sheet and contained photographs of twenty-one welding jobs. One of the small advertisements is reproduced herewith, and alongside it is the company's trade mark.

A Trade Mark That Tells a Welding Story



Telling It to the Orientals

The report of the Welding Wire Specifications Committee of the American Welding Society has been completed and will be published next month. It includes specifications for both gas and electric welding. The report will be available later in bulletin form.

HOW DO YOU CHARGE?

The Major and Minor Items That Enter Into the Cost of Doing a Welding Job

By B. Heyman

APART from the actual preparing, welding, and finishing of any job, estimating correctly is probably the most important consideration in any job welding and repair shop. Soliciting work is salesmanship pure and simple. The quantity of work that can be procured when the salesman depends upon friendship or an established reputation may be of great volume, but there are times when close competition prevails, and then it is that mere salesmanship is insufficient. The solicitor must then be not only a salesman, but also an engineer well versed in the intricacies and possibilities of the art. He must also be enough of a practical man to be able to point out the various elements of cost and estimate the quantities of material and also approximate the working time for the different stages of the welding process. He need not be an expert accountant, but he should be ready enough with his figures to calculate to a nicety all the various items that enter into a proposal which may culminate in a formal contract.

There are occasions when the welding concern has so ingratiated itself into the good graces of its customer by previous services of emergency nature, that no question of price enters into the transaction. In such a case, the shop records will provide all the information necessary in billing for the work upon delivery. Yet, the maintenance engineer or purchasing agent who is responsible for sending out the work to the welder has at heart the fundamental idea of low cost with efficient results and demands to be shown. He rarely passes out work without asking for an approximate estimate, or, in some cases sets for the welder a limiting figure which the job will stand. The latter is generally the result of peculiar circumstances, and many phases must be gone through before enough confidence is placed in the welder to justify such a method.

The writer had an interesting experience of this type in connection with work for a large eastern rubber company. All of the above mentioned phases entered into the transactions and show how one job formed a stepping stone to the next with gradual breaking down of formal business barriers, until finally all work was turned over carrying a maximum allowable price charge.

The first contract called for welding several large mill housings, and as a result of very low bidding—in fact, there was but little margin allowed to cover unforeseen emergencies—the work was obtained. Upon delivery of the castings to the engineer of the rubber company, the writer called upon him with the idea in mind of establishing a cordial relationship which might lead to future business, based, of course, on the assumption that our initial work had been perfectly satisfactory.

Although in every way satisfied, the engineer seemed to be very stern and business like, and, in the course of his remarks stated that he was still "from Missouri." He wanted to be shown and did not consider that first job a fair chiterion, although in our opinion it had been a "corker," encompassing all the difficult problems that enter into an oxy-acetylene weld of large proportions. But what he wanted was what any other customer would have wanted. It was up to us as an organization to show him by our work, and also by our charges, that he was perfectly safe in placing his confidence in us. It was up to us to "deliver the goods," so that, at the occurrence of any breakdown, he could say to the Purchasing Agent, "Phone so-and-so, and tell them we are sending down a casting to be welded. Let them bill us upon completion. They are honest. You needn't bother about any estimate."

And that was what we accomplished, not only in this one case, but in our dealings with many other customers. It did not take very long before we estimated for the same concern on several large gears with broken teeth and cracked spokes. Our bid was low enough to obtain the work for us, and we turned out perfect jobs.

A week later the flange was knocked off a mill pinion at this same rubber company. At 1 p. m. we were authorized by phone to handle this work and return it as soon as possible. At 6 p. m. it was back on the machine, and production loss had been practically negligible. The next morning our bill was mailed, and upon receipt of same we were surprised by a phone call from the engineer of this same company. As he aptly expressed it, "You've certainly sewed us up on our future work. I thought that job would cost at least three times as much." The low price and speedy service had finally turned the trick. It had been fortunate for us that no price had been asked when we were notified about the work. And our bill, being based merely upon the elements of material, labor, etc., had really surprised the executives who were responsible for sending us this work.

For some time after this no welding work occurred at this plant, but one morning the mail brought us an order reading in part:

"Oxy-acetylene weld shaft and return as soon as possible. Maximum charge allowable, $..... (Kindly have representative call to see whether you can keep within the above price and to receive instructions from our Engineering Department)."

Needless to relate, the work completed for less than three-quarters the stipulated amount. Now it is unnecessary to bid any longer for this company's work. They have been shown and are satisfied.

On the other hand, there are concerns that will under no condition send out work without having at least two or three competitive bids. It has been so customary in the past for welders to take advantage of customers that the oxy-acetylene users have become wary and suspicious of all operators. The fact that a broken casting was worth a great deal of money to replace, or might even be unreplaceable, and might be a source of delay to the regular production routine, with attending financial losses, was the basic idea in setting a price for work performed. Generally an innocent sufferer was badly "gouged."

The welder did not take into consideration—and a great many do not do so even at the present day—the fact that every job is a marketable article, whose selling price must be determined upon the basis of labor, material, overhead, and a reasonable percentage of profit. There are occasions when the element of risk attached to the work is so great, in so far as the success of the job is concerned, that proper stipulation should be made to compensate the welder for any losses that may be sustained by failure, or reward in case of successful completion. In this way the customer has, by his own consent, become a party to an honorable business proposition, which eliminates any heckling and bad feeling at a later date.

It is a well-known fact that the size of the broken section and the method of preparation determine the amount of filling rod required to repair the piece. It would be foolhardy for any welder to attempt to set a price on any job without analyzing at least in a superficial way what materials are required; and these depend primarily upon the size of weld. Where there is very little chance of competition, an arbitrary

figure may be set upon a job, but in such cases the welder is always certain to protect himself.

Some shops have gone so far as to check up several jobs very accurately, and from the materials used and the labor item have calculated the cost per cubic inch for welding the various metals. Basing their estimates upon the average cost per cubic inch, they have charged prices accordingly. Although this method was a step toward the solution of the problem, still it was a very crude method and left much to be desired.

Accuracy is of utmost importance, and the above method depends to a great extent upon guess work. No two pieces of work are identical as regards chemical composition, type of fracture, alignment, etc. Neither is the human factor a constant. Being variable even on work of similar nature, it is hardly to be expected that the human factor will be able to control two dissimilar jobs so that the cost basis will work out, and it is to be remembered that it is the lot of the job welder to handle a great variety of metals and parts.

On such metals as aluminum (particularly on crank case work) it is almost hopeless to attempt to set a price on the quantity of metal to be added. The metal added in repairing a crank case may be negligible compared to the amount of labor and experience that must be drawn upon to accomplish the welder's purpose. The many intricate problems of expansion and contraction which enter into work of this sort, and which must be handled in proper manner, demand that the welder be recompensed for his ability and ingenuity rather than on a basis of labor and material. For this reason this one definite department of work offers many opportunities for the welder to victimize his customer. Prices are determined in almost hap-hazard fashion. Generally the charge is set by the minimum price of a replacement charge. The welder knows that there is a happy medium which he cannot exceed and generally charges just high enough to make the customer feel that by welding he may save something, although it will be necessary to retain the old casting.

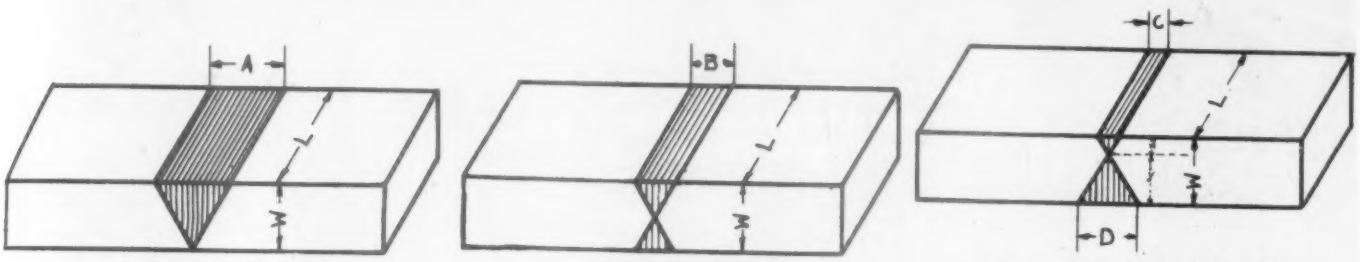
Of course, we must not overlook the case of parts that are unreplaceable. In such cases the price as above set could be considered in every way reasonable, as it is the only means to an end for the customer—namely, the repair of a machine which would otherwise be utterly useless.

Actually there should be no necessity for such a condition. There is enough profit on the average welding job to make such overcharging a thing unknown. To this some will say that "the customer does not know he is being overcharged. be the attitude to take. Welders should obtain a fair price, and it is a matter of business ethics—nothing more—for them to determine what that fair price is.

On small parts the usual custom seems to be to set a minimum price for less than which the welder will not even light his torch. His maximum, however, depends upon human inconsistency. Here again, it is difficult to estimate on the quantity of material, and he usually "pumps" the customer regarding new castings and prices and acts accordingly. On this type of work prices are so low that the customer is fairly safe, although at times he may find himself paying as much for the repair work as a new casting would cost were he able to obtain the new part.

Most of the work that enters a welding shop, no matter how variable in character it may be, is of cast iron. It would be safe to assume that 90 per cent of the repairs handled in oxy-acetylene job shops are of that metal. No unusual conditions are met in handling cast iron, as is the case with aluminum or bronze alloys, even though at times the welder's ingenuity may be taxed to the utmost in aligning the broken sections and caring for the strains which are co-existent with the several stages of preheating, welding, and annealing.

It is a rare occasion when a cast-iron break can be handled without any preparation. The alignment of parts, beveling of broken edges, and preheating are essential features. The angle of bevel depends of course on the thickness of casting, and may vary anywhere from 60° to 90° or a combination of both angles, using the acute angle at the lowest portion of the break and gradually widening out at the top. The bevel may be produced on both sides of the casting or on one side only. Furthermore, the bevel may be produced by the crudest of methods, namely, sawing slots and chipping out with a hammer or burning out with the oxy-acetylene flame after the



Volume=½(A x W) Volume=½(B x W) Volume=½(C x X) + ½(D x Y)

casting is preheated and ready for welding. The cheapest, and by all means the most efficient, is the use of a pneumatic hammer. Unskilled labor does not command the high prices at the present time that it did during the past few years and can be depended upon to perform this type of work most satisfactorily and economically.

The question of bevels was discussed in a very interesting manner in a recent issue of The *Welding Engineer*, although the question simplifies itself into a mere solution of simple arithmetical problems which are not beyond the grasp of the ordinary welder or shop mechanic.

Every school child knows that the area of a triangle is calculated by multiplying the base by the altitude and dividing by two. In the usual weld, the addition of material is generally in the form of a triangular prism, the volume of which can be found by multiplying the base area by the length of the weld. In other words, if the length of a break were known and the thickness of material, it would resolve itself into a problem where the height of the prism was the length of weld, and the area of the prismatic base was the welded section, the altitude of which would be the same as the thickness of the original material. The base of this triangle would necessarily have to be approximated with proper allowance for the angle of bevel. In some welds the bevels are made from two sides, necessitating the solution of two triangular prisms. Many times the break is of such direction and through so many different thicknesses of metal that several volumes must be solved and the summation of all of these volumes taken as the value of material to be added.

The figure so obtained does not in any way indicate actual rod consumption, since there are many losses during the fusion process both through volatilization and careless wasting of short ends. Also, the welder may find the body of metal so dirty that the original beveled faces are entirely unsuitable for producing a good "landing," and he may be compelled to fuse these faces and puddle away the edges until the volume of added material has been increased considerably.

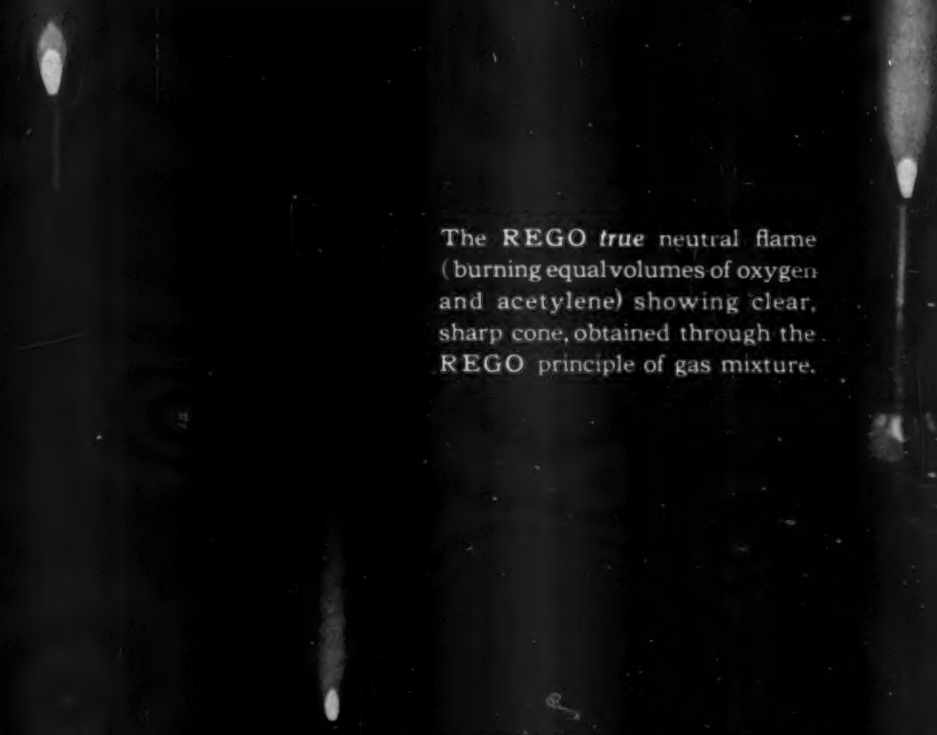
The amount of reinforcement must also be taken into account. A simple method for doing this would be to have recourse to the average weld efficiency of a section equivalent to the original cross-section, and then add enough cross-sec-

WELDING AND CUTTING APPARATUS

Welding Torch Flames

Produced by tips of the same size

Reproduced from actual photographs



The carbonizing flame, caused by excess acetylene, and denoted by the feathery edge of the cone.

The REGO *true* neutral flame (burning equal volumes of oxygen and acetylene) showing clear, sharp cone, obtained through the REGO principle of gas mixture.

The oxidizing flame, caused by excess oxygen, and denoted by shorter envelop and pointed cone.

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THE BASTIAN BLESSING COMPANY

WEST AUSTIN AVENUE AT LA SALLE STREET CHICAGO.

WELDING AND CUTTING APPARATUS

FLAME, the **true neutral** cone of heat, obtained without effort on the part of the operator, is the perfect welding and cutting flame of today.

The R E G O principle of low oxygen pressure insures not only a perfect flame, but the utmost in gas economy. In ordinary service R E G O saves from $300 to $500 a year in oxygen consumption alone. In tip maintenance, the R E G O one piece tip, made of drawn copper, saves 90% of the usual tip maintenance costs.

In eliminating "flash back" R E G O saves in upkeep costs —and there is no condition of operation which will cause a R E G O torch to flash back.

To get a clear understanding of R EG O principle of gas mixture, send for our book

"FACTS"

It is a concise compilation of gas mixture principle that will be of real benefit to you.

Included in "FACTS" is a true photographic color chart of correct and incorrect welding flames—the first to be shown in welding literature.

THE BASTIAN BLESSING COMPANY
WEST AUSTIN AVENUE AT LA SALLE STREET CHICAGO.

tion to bring the welded area efficiency to 100% or higher. Assuming the average efficiency to be say 80%, it would therefore be necessary to add 25% more section to produce a weld whose strength would equal the original material.

Actually, the weld efficiency attains a much higher value, and it is a rarity to find a welder adding 25% to the cross-sectional area of a casting. Not only because of the appearance of the casting, but also from a standpoint of material and labor cost, such a procedure would be prohibitive. Generally, the reinforcement amounts to ⅛" in thickness on heavy castings and varies to practically nothing on light sections.

From the known fact that a cubic foot off cast-iron weighs 486 lbs., it is readily calculated that a cubic inch of filler rod weighs approximately .25 lb.

1728 cubic inches = 486 lbs.

1 cubic inch $\frac{486}{1728} = .25$ approx.

This constant gives us a close enough value for estimating the amount of filler rod required. The current market price determines the cost of material which will be utilized for the work being considered.

A good flux must also be used in welding cast-iron. Most shops purchase this material from some company or other, paying a price which varies between wide limits, depending entirely upon the selling overhead of the particular organization concerned, since flux is at the best a very cheap article. In fact, the quantity used on even the biggest welding jobs is almost negligible, but a safe assumption would be about a pound of flux to every twenty pounds of filler rod.

The quantities of bases used in welding and the time required to perform the welding operation are the most indefinite items, although the former may be calculated with some accuracy and the latter determined by applying the benefits of previous experience. From a series of accurately and carefully filed records it has been determined that for every cubic inch of cast iron filler (.25 lb.) approximately 8 cubic feet of oxygen are consumed on the average job handled by a skilled operator. In many cases this constant may be found to be too high by 1 or 2 cubic feet, but for an average value it is a very fair assumption. At any rate, it is high enough to cover the majority of jobs and can be used in estimating.

Since all torches are designed so that the neutral flame is supposedly produced by an equal mixture of oxygen and acetylene at the orifice tip, a ready means is offered for calculating acetylene consumption. To attain the ideal condition of a 1 : 1 ratio is impossible with the torches now on the market. This ratio is more often in the neighborhood of 1 : 1 : 1. Therefore, the acetylene consumption is generally about 90% of the oxygen consumption.

There is one large item to be considered in welding operations which introduces an element of uncertainty. This is the cost of preheating, whenever it becomes necessary. On the majority of welds, localized preheating will be sufficient, and the estimate which takes this into account will surely have the advantage over an estimate covering preheating the entire casting. On the whole, experience will determine the cost of this item although there are many variables which may cause it to fluctuate one way or the other.

The fact that the rate of heat transmission is greatest between points of greater temperature difference must be balanced against the expansion forces and the results produced by these forces. On some castings it may be possible to force the preheating agent while in others a very gradual increase in intensity is the only suitable method.

Other considerations are the type of fireplace, draft, fuel, etc. But above all the human factor controlling these takes precedence. In the ordinary job welding shop it is a simple matter, where charcoal is used, for the welder, through his ignorance or carelessness, to waste a great deal of this fuel.

There are a number of minor items which also enter into the cost of a job and which must not be overlooked. Asbestos, moulding compound, carbon plates, carbon rods, fire clay, etc., must all be taken into account. These materials are most readily considered as a whole. One or two large jobs offer a fair idea as to the amount which will cover them safely.

In the welding of steel the job welder is fortunate in having for his use the numerous manufacturers' tables which give values for sizes of plate up to 1" and over. On the whole these tables are underestimated for the conditions under which the job welder must work. A fair allowance must be made over and above these tabulated results in order that losses shall be avoided.

Steel castings can be handled in similar fashion to cast iron, although the constants given for use in cast iron welding are entirely unsuitable for steel casting work. The methods which must be employed in the handling of steel castings control to a great extent the price which must be placed on the work. The operator should never overlook the fact that preheating with fuel oil or charcoal, not only eliminates strains, but also brings the casting to a high temperature at a lower expense than if oxygen and acetylene were used.

Thus far the writer has merely analyzed the labor and material items which enter into the cost of welding. Actually, the final cost is made up of a great deal more than this. Stated simply the final cost is the sum of

LABOR
MATERIAL
OVERHEAD
PROFIT

Overhead is a term which means little to the welder or mechanic whose shop is jammed full of work at all times—work whose price is fixed without consideration to anything but the value of the part. And as stated previously, in such a case the welder rarely errs to the customers' advantage.

Several very elucidating articles have already appeared in *The Welding Engineer* explaining at length what overhead is and how it is ascertained. Briefly, overhead is that item which distributes to each job a proper apportionment of all fixed expenses. Every shop has bills for the following: rent, light, heat, clerical work, etc. Also there are expenses for apparatus, fixtures, etc., from which interest on investment is ascertained, while depreciation of plant, insurance, advertising, etc., all take money out of the office and must be in some way repaid through work being performed. To cover these expenses by plastering an enormous profit on one or two jobs would be ridiculous. The safe and sane way is to distribute this expense over all of the jobs. But it is first necessary to determine what this expense is and how to apportion it.

As stated before these items are fixed expenses because they are practically the same from year to year. Running expenses, on the other hand, cover labor and material and must be ascertained for some definite period by carefully kept records. Dividing the fixed expenses for a certain period (which must be long enough to insure a safe average) by the running expenses for the same period gives the percentage of overhead. That is, if a certain shop had a labor and material expense of $10,000 for the year and fixed expense of $5,000 for the same year the overhead would be $\frac{5{,}000}{10{,}000}$ or 50%. Then any job would have to be charged for, by allowing 50% above the labor and material cost to distribute to that job its share of the fixed charges.

Profit depends upon human inconsistencies. Where one man may be satisfied with a small profit and depend upon volume of business to give him a fair return, another may demand a large profit although it may mean the loss of many customers. I shall not attempt to indicate what I consider a fair percentage of profit since there are many who think

Specialized industrial training eliminates mistakes that are costly in time and material

Free School for Arc Welders

THE above illustration shows three views taken in the General Electric Company's Arc Welding School at Schenectady, where courses are given in horizontal, vertical and overhead welding, including:

Repairs to steel and iron castings
Welding steel plates, tanks, gear-cases, etc.
Recovery of broken taps and drills from castings
Welding of high-speed steel to low-carbon steel
Welding and cutting by carbon arc
Welding by metallic arc
Assembly of various parts by arc welding

In from six to eight weeks, men who have had no arc welding experience become efficient welders at the General Electric Company School in Schenectady.

Each student's record is kept and will be mailed on request to employer sending him to the school.

This training enables an operator to hold a steady arc of uniform length, which is necessary to produce a successful weld.

Many prominent firms, and departments of the U. S. Government, have availed themselves of the opportunity to have their men receive this exceptional training.

Instruction is free of charge to a limited number of men desirous of learning electric arc welding.

More details in Bulletin No. 48953 of our Arc Welding School sent on request.

General Electric Company

General Office Schenectady, N.Y.

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otherwise than myself. Local conditions, also, may play an important part in the determination of what this should be.

It would be well to summarize at this point the many little details which the welder must analyze in reaching his final cost. I do not claim that I have inserted all of these details but an attempt will be made to include as many important ones as possible.

Labor
Preparing
Aligning
Beveling
Preheating
Welding
Special treatment
Machining
Finishing
Testing
Materials
Filler Rods
Fluxes
Fuel for preheating
Asbestos
Carbon in various forms
Miscellaneous shop items not listed under tools, such as goggles, gloves, etc.
Delivery—service wagon
Oxygen
Acetylene
Firebrick
Overhead
Insurance
Taxes
Interest on investment
Depreciation
Rent
Heat
Power
Light
Non-productive labor
Clerks
Solicitors
Supervision
Repairs to apparatus

Often times work must be shipped to and from the welding plant, thus producing express and freight charges. Such charges are generally set against the customer. As noted above under overhead, there is an item for delivery which covers daily service in bringing and taking work from the welding shop. This must not be conflicted with such drayage charges as are incurred on castings in transit from out of town and which are charged directly against the customer.

It would be well to say a word or two about cost cards. No matter how successful a shop may be as regards the type of work, it can hardly expect to succeed financially in these days of close competition if a systematic record is not kept of all work. A cost card for each job is an inexpensive item, although its proper use entails some time. It probably would be unwise to have to resort to the welder for all the information necessary in filling out the various headings. Furthermore, the type of work which he performs is not conducive to a clean looking card, so that this should be part of the office routine. It may be far fetched to expect a clerk to handle the quantities of materials, but upon further consideration, there is no one better fitted than one of the office help. If a clerk is responsible for the final cost he will be sure to obtain all the quantities; besides observing the labor entailed so that the total time may be ascertained.

Cost cards vary decidedly in different plants, so that it seems to be an individual matter as to what should be specified on it. Still, there can be little deviation from the scheme laid out in a previous paragraph if the true expenses are to be entered against the work and a fair price charged.

In conclusion it may again be remarked that every welding job has its market value. Over charging a customer is unjust. Although it is a very simple thing to do, it certainly does not constitute good business ethics to play on the public's ignorance of what constitutes fair value in welding. Even now the idea is prevalent in many sections that some welders have become "business highwaymen." Not only does this impression give the art a black eye but it also casts its reflection on the majority of welders who are in every way innocent. Fractured parts which should have found their way to the job shop are sidetracked to the scrap heap and replaced by new material, while the job welder is minus a great deal of patronage.

Play fair. Instill confidence in the public by honest dealings and the good will which is so necessary to successful business will surely result.

GOOD EXAMPLES OF HEAVY WELDING

Two heavy welding jobs recently accomplished by the Atlas Welding & Cutting Co., of St. Louis, are illustrated in these two photographs. One is a 6500 lb. draw press, on which the area of each weld was about 110 square inches, the welds having to stand a working pressure of 100 tons.

3,500-Pound Blanking Press

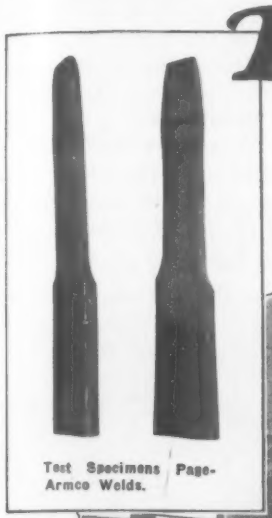
The other weld is on a 3500 lb. blanking press which was broken all the way through on one side and half way through the other side. This press is used for cutting out plates of steel for bottoms of steel barrels. The welding repair meant a saving of about $400.00 in this case.

Preheating was necessary in both cases. The method of procedure in the welding of such large pieces is to put them

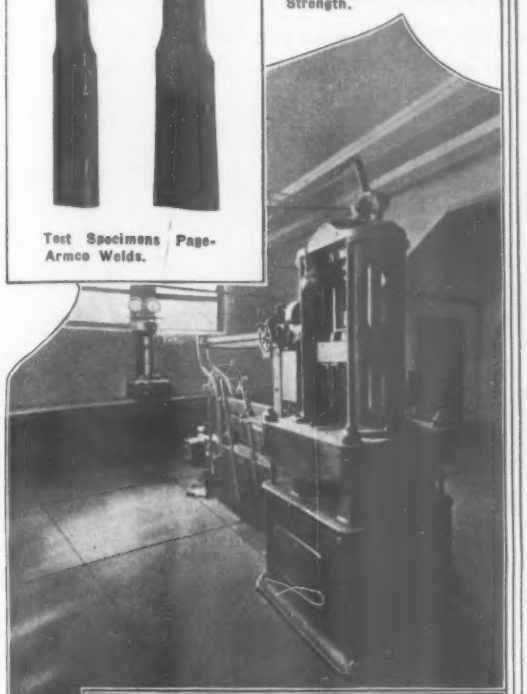
6,500-Pound Draw Press

under the crane so they can be turned easily and draw the fracture together by means of rods or large chains, so that the fracture is snugly closed, then build a firebrick furnace. Charcoal, oil with air pressure or city gas can be used for preheating. When the casting is a bright cherry red they use the torch to cut out a slot at the fracture, sufficiently

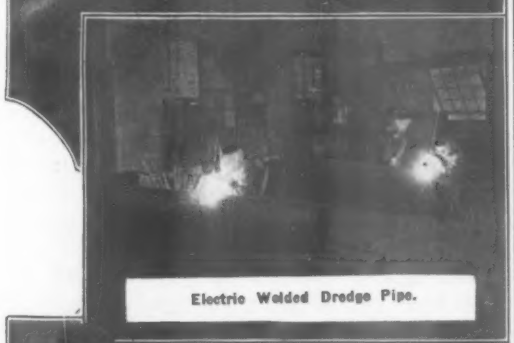
Determining PHYSICAL PROPERTIES of the WELD



Test Specimens Page-Armco Welds.



Testing Machine for Determining Tensile Strength.



Electric Welded Dredge Pipe.

Gas Welded Corrugated Culvert.

Examination by the microscope reveals the nature of the grain structure and readily determines imperfections and defects and in most cases will indicate the existing weakness, but at present there is no definite relation between the grain structure of a weld and its tensile properties, making therefore comparative tests essential.

For comparative efficiency of Weld to parent or base metal it is necessary to apply the same test methods to the welded joint as to the plate itself.

PAGE-ARMCO welding rods and electrodes are consistently correct as to physical and chemical properties which eliminates the expense of repeated tests by the chemist and welding department.

PAGE-ARMCO Welding Rods and Electrodes meet all requirements of the American Welding Society.

Page Steel & Wire Co.

Bridgeport, Connecticut

DISTRICT SALES OFFICES:
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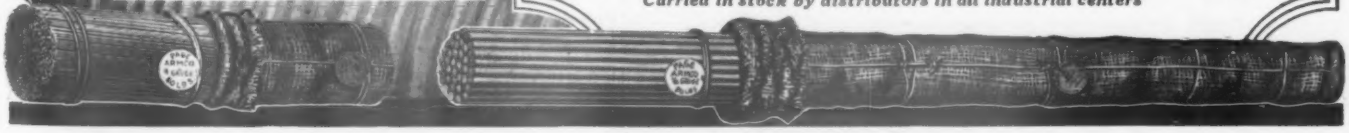
Rods—Ingot Iron and Special Analysis Steels.
Wire—Plain and Galvanized—Spring, Rope, Telephone, Telegraph.
Fence—Woven—Right-of-Way and Farm-Chain Link, Factory Partitions, Gates.

INGOT IRON

Carried in stock by distributors in all industrial centers



PAGE-ARMCO
WELDING RODS and ELECTRODES

wide and deep to allow the welder to reach the center of the casting or deeper.

When one side is completed the casting is turned and the other side handled in the same way. On large jobs it is a good plan to have two welders working, for while they may not both be able to work at the same time they can change off, thereby keeping at least one torch on the job constantly. This gets the work done with a minimum of heat.

SAYS WELDERS SHOULD BE LICENSED

Editor:

In the course of several years at automobile welding and also the heavy work that comes to the welding shop, I have found that most of the mistakes are being made in the automobile repairs, especially repairs to malleable parts. Several jobs come to my shop every week which have done their share to make the public suspicious of welding. Rear axle housings, lamp brackets, running board steps, supports, and windshield supports are among the most common. Nine out of every ten are ruined with cast iron, which must all be ground out, and thus a small job becomes a large one, often demanding a charge greater than the cost of a new part. But if the work is turned down on account of its cost, the customer who has already been stung once and is skeptical of the process, goes away thoroughly convinced that we are all failures. I have always tried to do my best on jobs of this sort, even though I could not break even on them, because I figure on getting all of that customer's future business. Automobile parts are, as a rule, well made and of good material, so a welder can make a good profit repairing them, but I truly believe that there are more of these parts ruined than parts of any other kind of machinery. The only remedy to the situation which arises from the attempts of the inexperienced to bluff through with this work is to have the State demand that shops doing welding display a card to the effect that their welders are licensed men. Similar demands are made of plumbers in many states. If such regulations were adopted, the welder would be given the credit due him, and the customer would know where to go to get the real benefit of the money-saving process.

W. H. OSBORN.

PERFECT PACKAGE MONTH

Postmaster Arthur C. Lueder, of Chicago, announced recently that the Post Office Department and the express railway companies have joined in a nation wide effort to stimulate greater interest in the good packing of parcel post, express, and freight packages. November has been selected as the "Perfect Package Month," during which an active campaign will be conducted to induce all mailers and shippers to give their attention to the manner in which their goods are packed, kind of containers used, and the writing or marking addresses plainly and completely. This is of great public interest, because in the end the public must pay the bills for lost or damaged shipments. Therefore, the public should be deeply interested in the campaign which will tend to reduce losses and improve the service.

Christmas will soon be here, and it is especially desirable that care should be exercised in the presentation of packages at this time, because now the occasional mailer or shipper will be sending packages. Articles easily broken should be carefully wrapped in corrugated or shock-absorbing paper. The department stores use this kind of paper in delivering breakable articles, and it would be an excellent practice for housewives to save this paper for use when they are sending out their own packages.

CATALOGS WANTED

Wm. Beaton, 231 Walker Street, North Sydney, New South Wales, Australia, would like to receive manufacturers' catalogs of acetylene generators, torches, butt welders, fluxes, rods and other welding apparatus.

HOBBIE'S OUTFIT PUTS SPEED IN SERVICE

If any man needs help in as big a hurry as a drowning man needs it, that fellow is the motorist with a wrecked car. L. W. Hobbie, proprietor of the Hobbie Welding Plant at Hampton, Iowa, knows how to fix them up, as can be seen in this photograph of his service truck, used in handling heavy jobs and picking up wrecked cars, carrying them in with the front wheels off the ground. The casting in the picture is an 850-pound cast-iron tractor transmission with the one bearing support broken off, which can be seen inside of the case.

This car is completely equipped and can easily handle a two-thousand-pound load from the end of the derrick, which extends about six feet back of the rear axle line. The car can be

This Outfit Means Quick Action on the Big Jobs

used as a "carry-all," taking men out to jobs. It has a pull cable direct from the rear axle to be used on heavy pulls, also has a pull bar from the rear step. The equipment consists of shovels, sledges, steel stakes, hooks and chains and two steel cables, one is used in connection with a snatch block to give double pulling power to the car when getting cars up embankments. There is a portable gas light, which can be set out on the ground wherever convenient, besides a spot light on the top of the cab. In towing cars, a short "Y" pull bar is used to pick the front end of the car up, and often one man will bring a car in alone, leaving the second car in gear, switch and throttle on, so that when he starts the truck the motor in the disabled car helps propel itself and relieves the pulling load on the motor. It is also equipped with a Weaver Ambulance in case the rear end has to be carried off the ground. This truck is one of two they have built, using a Willys-Knight 88-4 motor and reinforcing the chassis, and with four springs on the rear axle and equipped with Republic cord tires. The total weight of the truck is 4,600 pounds and readily travels at 40 miles an hour when empty, towing a car in at 25 and 28 miles an hour. In order to make this investment pay, they advertise: "When in trouble on the road, telephone us, and we will pull any car to any garage in our city."

This concern has been in the Oxy-Acetylene welding business for the past eleven years, specializing in the most difficult jobs on aluminum parts, crank cases and cylinder blocks, and his built up a business that employs three to six men the year round.

AUTOMATIC ARC WELDING SAMPLE BOARD

Many questions asked by prospective users of welding equipment are answered on the combined sample and data board made up by the General Electric Company, on which is mounted a collection of samples representing various types of welds that can be made with the automatic welding equipment. Each sample is numbered, and after the corresponding

number in the table below is given the data on the welding speed, the size electrode, and the current used:

Sample Number	Type of Weld	Gauge of Metal	Welding Speed Inches per Min.	Welding Current	Size of Electrode
1	Angle weld	16	14	75 Amp.	1/16"
2	Angle weld	13	10	120 Amp.	3/32"
3	Angle weld	11	9	110 Amp.	3/32"
4	Angle weld	7	5½	130 Amp.	1/8"
5	Angle weld	3	3½	150 Amp.	1/8"

A Display Which Shows the Customer Finished Jobs on a Variety of Samples.

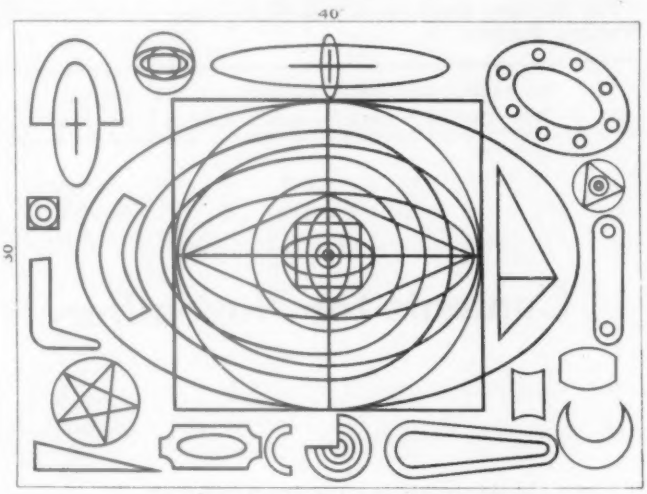
6	Section of bottom of oil switch tank, lap welded	11	9	120 Amp.	3/32"
7	Lap fillet weld	16	10	60 Amp.	1/16"
8	Butt weld with backing strip	16	11	130 Amp.	3/32"
9	Butt weld	11	9	140 Amp.	3/32"
10	Lap weld	20	12	65 Amp.	1/16"
11	Edge weld	16	12	60 Amp.	1/16"
12	Butt weld	16	13	70 Amp.	1/16"
13	Lap fillet weld	13	10	105 Amp.	1/16"
14	Butt weld	13	10	100 Amp.	3/32"
15	Edge weld	11	9	110 Amp.	3/32"
16	Lap fillet weld	11	9	140 Amp.	3/32"
17	Butt weld	7	7	180 Amp.	1/8"
18	Butt weld	3	5	175 Amp.	1/8"
19	Fabrication of steel	9	8	150 Amp.	3/32"
20	Automatic will weld over irregular contour	9	8	150 Amp.	3/32"
21	Quarter section of built up worn or undersized shafting	..	8	140 Amp.	3/32"
22	Section of welded tubing	1	3	170 Amp.	1/8"
		11	9	120 Amp.	3/32"
		18	20	65 Amp.	1/16"
23	Section of steel faced copper railbond hand welded to steel rail	..	*	175 Amp.	3/32"
24	Butt weld — three layers	½"	2	170 Amp.	1/8"
25	Lap fillet weld—one layer	3	5	175 Amp.	1/8"
26	Welded steel tubing	20	25	50 Amp.	1/16"

*Total time to weld bond to rail—3½ minutes.

These boards are supplied to branch and district sales offices, and they save considerable time by showing at a glance what would ordinarily be difficult to describe. Most men who are making their first investigation of welding are totally unfamiliar with the various types of welds and the methods of making them. Here they are showing the welds made on the very stock they wish to use, and all the important data regarding the operation is right in sight.

ELLIPSOGRAPH CUTS VARIETY OF SHAPES

A new member of the family of oxy-acetylene cutting tools has recently been introduced to the trade by the Shawver Company, of Springfield, Ohio. The newcomer is the Ellipsograph, designed to make possible the rapid cutting of circles, ovals, ellipses and a great variety of odd shapes from sheet metal or plate. It is a mechanical device for controlling the motion of the oxy-acetylene cutting torch. The illustration shows some of the figures that can be cut with it. The



Numerous Shapes Cut by Ellipsograph

construction is so simple that there are very few parts to get out of order, and it is substantially made throughout. Also, every part is visible, making it an easy matter to secure accurate adjustments and to locate any trouble that might occur on account of accidental mishandling. The machine is especially recommended for boiler works and similar shops where there is a quantity of cutting to be done on sheet and plate metal.

AN ATTRACTIVE AD FOR "RACO" WIRE

The Reid-Avery Company of Philadelphia sends out this month an attractive folder showing the stock room and cutting room in the new plant of the company at 21st Street and Washington Avenue. The extensive stock on hand at this warehouse, says the folder, includes the seven different "Raco" wires—and makes instant delivery practicable when required. information in the circular.

A list of the important wires and their uses is included in the

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What Increased Membership Means

DURING the current month the Philadelphia Section of the American Welding Society has prepared and mailed to members two installments of printed proceedings for the present fiscal year. These papers cover a wide range of subjects and are well printed on forms especially prepared for preservation in loose-leaf binders. Included in the papers are many discussions of important welding questions. The two installments already sent out are just a promise of the larger production, i. e., the complete volume of 200 or more excellent papers, which will be distributed to all paid-up members if the members themselves furnish sufficient encouragement. This encouragement can come in two ways; first, by the payment of delinquent dues, and, second, by increase in membership. The Philadelphia Section has set an example of spirited determination to make progress, to boost the Society and to make membership mean definite, tangible returns. Mr. W. T. Bonner, chairman of the Philadelphia Section, has worked tirelessly on the preparation of all this material and has turned it out in excellent form. This splendid piece of work is a sample of what the parent organization can do for all members of all sections as soon as the membership can be increased sufficiently to pay the expense of it. One technical bulletin has already been printed this year, another will be ready in a few weeks, and more are in preparation. A large membership means that funds will be available for the printing and circulation of bulletins which will be useful to everybody in the industry. Get such activity well under way and there will be no question of the value of a membership in the American Welding Society.

A Welding Organization

OFFICIALS of the Rock Island Lines can well be proud of the thorough manner in which their welding procedure has been organized. Mr. Wanamaker's paper in the proceedings of the American Welding Society for this month includes a bird's eyeview of the welding organization within the railroad organization, with some interesting details on how different phases of the work have been standardized. The one sure way to make autogenous welding succeed is to treat it as a real job, to be handled by trained men, under the direction of able and conscientious supervisors. It has been treated this way on the Rock Island Lines, and instruction material has been prepared so elaborately as to justify copyrighting.

Stimulating Business Revival

SPEAKING before the annual convention of the Associated Business Papers, Inc., James H. McGraw, president of the McGraw-Hill Co., New York, points out that there are many avenues along which business papers can work in speeding the revival of business. "If the business papers collectively and individually can instill into the minds of thinking men of industry the gospel of intelligent work," said Mr. McGraw, "we will have performed a tremendous service.

"Intelligent work, untiring work, work in its most homely sense.

"We cannot talk ourselves into prosperity. We cannot argue ourselves into stability, but we can work ourselves out of the valley of depression and up to the heights of plenty. We can do these three things.

"First, everybody get busy at his present task, and make the most of it.

"Second, everybody consider winning the peace in the same spirit as characterized the winning of the war.

"Third, the business papers, by article, editorial and personal service, show that selfishness has now no more place in war time. That interest in the welfare of all men, individually and as society, lies at the basis of prosperity."

Is this man saving your dollars?

Are you getting 100% service from your oxy-acetylene equipment?

Do you realize that the welding and cutting blowpipes will remake defective castings, rectify shop errors and cheat the scrap-pile?

An oxy-acetylene welded part is not reclaimed—it is *remade* and is ready for 100% service.

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in easily portable cylinders enables you to expand the use of oxy-acetylene, at will, to any department of your factory.

Quickly taken to any job, anywhere, the Prest-O-Lite cylinder supplies uniformly pure gas where and when it may be needed.

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PW-510-21

Hints for the Welder

When you finish an interesting piece of work, can you set down on paper the manner in which you went about the job, how you prepared the work and how the job was done? Have you learned some little stunt every welder ought to know? Contributions to this department are paid for. Write it down any old way – I'll polish it up. Make a rough pencil sketch and our draughtsman will fix it up fine. Line drawings are more practical than photographs. Do it today – the men on the firing line are waiting. L. B. Mackenzie, Editor.

CHASSIS WELDING

Editor:

Having read in the September copy of *The Welding Engineer* of a new method of welding auto chasis, and I have decided I would give a brief view and I think a decided improvement of Mr. Heyman's method of chassis welding.

In the first place, we use the electric arc for this work. It is never necessary to remove the radiator or gas tank and very few parts, only enough to give access to broken parts and never damage paint on body, regardless where the break or damage is on the frame, because we have no flame spreading to adjacent parts.

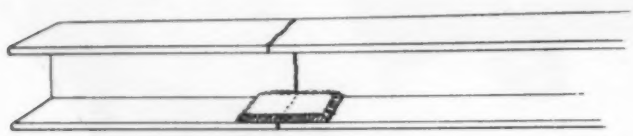


Fig. 1

Mr. Heyman's method of welding top and bottom lip of frame and setting in the side frame to form a "V" and welding same is probably very good, but we find by simply welding the broken parts and placing a reinforcing patch on bottom lip of frame either inside or out (about 6 inches long) we have very good results; in fact, not one has ever come back to us, and some are in service two years.

Our opinion is that, no matter how much reinforcing is placed on the inside of the frame, if the bottomlip is not reinforced it will break again, as the crack starts from the bottom nine times out of ten.

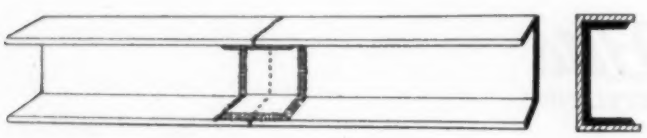


Fig. 2

Our method of welding a broken gooseneck of an auto is shown in Fig. 1, and in fact we weld all pleasure car frames that are broken in this way, but in this particular job it is quite a task because of the vibration. First, we align the broken parts and weld crack, then place small reinforcing patch on bottomlip and weld it in place.

Fig. 2 illustrates our method of welding truck frames, bringing broken parts to proper alignment and cutting out a space with the acetylene torch and welding same, placing a patch on the inside (a channel within the frame), and welding it in place. We have never had one come back.

L. EVANS.

CAST IRON CUTTING

A five-ton cast iron propeller hub was recently successfully cut in half with an oxyacetylene torch.

The thickness of this casting ranged from seven to ten inches. Two cuts were made, each forty inches long. No attempt was made to clean the casting although it had been lying in the open for months and was covered with rust. Nor did the operator preheat the hub preparatory to cutting. The photograph reproduced herewith shows how the job looked after successful completion. The work was performed under the direction of the Air Reduction Sales Co. at the shop of a large manufacturer of propellers, as a test of the cast iron cutting qualities of the torch.

In a shop such as this the value of the cast iron cutting torch lies in its ability to cut up heavy cumbersome castings

A Cast Iron Cut Which Saved a Neat Sum for One Manufacturer

which for various reasons have been discarded and must be got out of the way.

The cost of cutting cast iron with the oxyacetylene torch is about five times that of steel, and, in this connection, the following data prepared by the Air Reduction Sales Company, will be of interest to the man contemplating the use of an oxyacetylene torch for the cutting of cast iron.

"Steel 12 inches thick can be cut with oxygen and acetylene at the rate of about 30 square inches per minute, costing, say 1.5c for labor, 10c for oxygen and 2 for acetylene, a total of 13.5c to cut 30 square inches per minute.

"Twelve inch cast iron was cut at the rate of 7 square inches per minute, costing 1.5c for labor, 13c for oxygen and 4c for acetylene, a total of 18.5c to cut 7 square inches per minute.

"We may therefore calculate the following approximate figures on a basis of 100 square inches of metal cut:

To Cut by Hand Torch 100 Square Inches of Cast Iron and Steel with Oxygen and Acetylene

Material	Time	Consumption Oxygen	Acetylene	Cost Time	Oxygen	Acetylene	Total
	Minutes	Cu. Ft.	Cu. Ft.				
Cast Iron	15	123	21	$0.22	$1.84	$0.56	$2.62
Steel	3.5	25	2	.06	.37	.05	.48

"While the above figures show the relative cost of cutting cast iron and steel with the oxyactylene torch to be high for cast iron, it is fair to note that the only other way to cut cast

iron, i. e., by machinery, would cost at least twice as much as cutting it with the torch. For example, a slab of cast iron costing $2.62 per 100 square inches to cut off with the torch would cost if cut by machinery at least $5.00 for labor and power if the casting were of convenient size to handle. However, the cost might be double that amount for machining a big, unwieldly casting. We may therefore summarize:

Comparative Cost of Cutting 100 Square Inches of Metal.

Metal Cut	Method Used	Cost per 100 sq. in.
Steel	By Oxyacetylene Torch	$0.48
Cast Iron	By Oxyacetylene Torch	2.62
Cast Iron	By Machinery	5.00

PLAY SAFE IN DECARBONIZING

By B. Heyman

In a previous article the causes, results and methods for removing the carbon from automobile cylinders were fully discussed. It was stated that, preliminary to applying the decarbonizing torch, it was necessary to shut off the gasoline supply at the tank, and empty the gasoline from the supply line and carburetor by running the engine until the fuel was exhausted. There is no doubt that this is the safest way and should be the only way to perform the decarbonizing process.

It is surprising to learn that in many service stations these precautionary measures are entirely ignored. It has become the practice in these places to clean the carbon at a very low rate (in fact, one place is performing the work for a flat rate of 60 cents for a 4-cylinder car). In order to make this rate include a slight profit over the labor, material and overhead charges, very rapid work is necessitated on the part of the operator.

For example, a car is driven into the garage, and, even before it has been stopped the decarbonizing outfit is wheeled over to it. The wires are removed and all the spark plugs, excepting that in cylinder No. 1, removed. The latter spark plug is loosened so that it can be readily removed. The exhaust cock in cylinder No. 1 is then opened, and the engine turned over by cranking. The operator holds his thumb over the exhaust cock and feels the compression. Immediately after the end of compression, just as the piston is ready to begin the down-stroke, the cranking is stopped. The exhaust cock is closed, spark plug removed and the torch applied, after injection of a few drops of kerosene and insertion of a lighted match. When cylinder No. 1 is clean, the crank is turned exactly one-half revolution, and the next cylinder in the firing order cleaned. Thus, in a 4-cylinder car, the routine might be either 1-3-4-2 or 1-2-4-3, one-half turn of the crank bringing the piston to the proper point. It is amazing to see the rapidity of the work, which takes on an average of ten to twelve minutes.

No precautions are taken to insure safety. The supply line is not shut off, neither is asbestos placed around the engine to prevent danger from sparks. The only safeguard is the placing of a fire extinguisher at some handy place.

I talked to one of these men after he had cleaned a car, and his attitude seemed to be one of security. According to him, setting the piston at the end of compression was coincident with the closing of both inlet and exhaust valves, and so there was no danger of back-firing into the supply line.

He did not seem to realize that slight deposits of carbon might have formed on the inlet valve seat, and so might leave an entrance for the oxygen into the chamber of vaporized gasoline and air—a very hazardous condition. Too much dependence was placed on the fire extinguisher, which he carried on his decarbonizing truck, and the fact that thus far no accident had occurred. But it only need happen once, and the damage will be irreparable.

There is no doubt that the method of testing compression and the routine is worthy of commendation, but a few added moments should be spent in safeguarding the car by following the adopted method of removing the fuel from the supply line.

WELDING CURVED PIPE COILS OF A GLUCOSE TANK

As the result of an unforeseen circumstance, a Thermit pipe welding job of unusual nature was recently performed on a helical 2½-in. standard pipe coil for the American Chicle Company, Long Island City, N. Y.

The coil in question was to be used to convey steam under pressure for heating a glucose tank and was first constructed in one piece measuring about 17 ft. in outside diameter and 14 in. from pipe center to pipe center of adjacent pipe turns. Because of the large size of the coil, however, it was impossible

The Coils Ready for Welding

to transport the coil to where it was to be installed, so it was necessary to cut the coil with an oxy-aceylene torch into two semi-circular segments by making 9 cuts and later welding these cuts together by means of Thermit welding.

As the cutting torch had left ragged edges, the pipe ends first had to be hack-sawed. The surfaces to be welded were next faced smooth with a pipe-facing machine, and the usual pipe welding operations then followed. Immediately after each weld was made the section having one end just welded and the other about to be welded was bent round to a shorter ra-

Joints with no Trace of Leakage

dius and into a proper position for the next weld, the red hot temperature of the weld just made enabling this bending to be made.

The results of welding were entirely satisfactory in every way, continuous joints being secured, with no trace of leakage whatsoever during a preliminary test of the welded coils under 40 lbs. steam pressure and later in service under a 5-lb. pressure intermittently for about two months up to the time of writing.

The work was undertaken for the American Chicle Company by the Carrier Engineering Corporation, Newark, N. J.

Carbic

A Three Minute Job

There's nothing complicated about the Carbic System for generating gas for oxy-acetylene welding and cutting.

Only three parts to the Carbic generator. See how quickly and easily they go together. Any man can charge it in 3 minutes.

The Carbic System is entirely different from all others. None of the inconvenience and waste of loose carbide, no transportation delays and no gas tank investment as with compressed acetylene. The Carbic principle of acetylene from cakes alone makes this possible.

Yet it is a **portable** unit—safe and dependable.

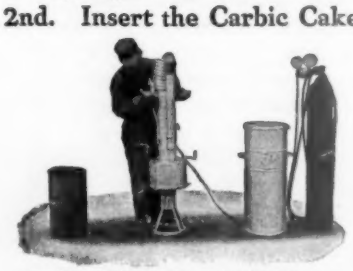
Consider the Carbic System for your work.

Catalogs and complete information on this—the latest system, on request. Write for them.

The Carbic line is complete, including generators, torches, regulators and all other necessary apparatus and supplies.

1st. Put in the Water

2nd. Insert the Carbic Cakes



3rd. Place Gas Bell Over Cake Holder

4th. Lower Gas Bell into Tank.

5th. Turn on the Gas

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The trade name Carbolite has represented our product continuously for many years. Its appearance on each package is a guarantee of its excellence and a protection to our customers.

Carbolite is carefully manufactured from best grade raw materials insuring at all times a superior quality, both in purity and gas yield. Our modern screening and inspection system also makes certain a thoroughly clean product, uniform in size.

Carbolite is made in all standard sizes and can be supplied promptly from warehouse stocks.

Packed only in Yellow Containers

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WAREHOUSES IN ALL CENTRAL STATES

A NEW BOOK ON AUTOMOTIVE REPAIR

"Automotive Repair," by J. C. Wright, is the title of a new instruction manual for the general repair man. Part I gives detailed instructions for doing a wide variety of automotive repair jobs, and in Part II is given a sufficient knowledge of the principles of construction to teach the repair man what he needs to know to keep a car in good running condition or repair and to thoroughly understand automotive equipment. It contains a wealth of material that will be useful to the man who is studying or engaged in automotive repair, for the emphasis is placed on the actual repair jobs rather than on the theory of design or detailed types of construction. The book contains 544 pages, is bound in cloth, and sells for $3.50. It is published by John Wiley & Sons, Inc., New York City.

DAVIS-BOURNONVILLE COMPANY ANNOUNCES SMALL OUTFIT

A welding torch and carrying case outfit for the garage and small machine shop has recently been announced by the Davis-Bournonville Co., Jersey City, N. J. The outfit consists of a torch, three extension tubes, five welding tips, a decarbonizing tube, oxygen and acetylene regulators and hose, lighter, goggles and wrenches, all securely and neatly packed for carrying in a substantial fibre case, with handle, metal hinges and fasteners. The price of the complete outfit is $55. This is not intended for a makeshift, temporary or emergency set of apparatus, but for any welding job on steel, cast iron, aluminum, copper, brass and other metal parts. A twelve-page booklet has been prepared, describing the outfit in detail and giving instructions for setting up and adjusting the apparatus.

GIBB CO. INTRODUCES NEW SEAM WELDER

A seam welder, the "Gefei," has just been introduced to the American market by the Gibb Instrument Company, Detroit, Mich. The "Gefei" welds seams in sheet metal by the electric resistance method. The machine has been successfully used for some time in Germany.

NEW CATALOG OF STRAND GRINDERS

Catalog No. 21, recently issued by N. A. Strand & Co., Chicago, Ill., lists a complete line of flexible shaft equipments for grinding, polishing, sanding, drilling, reaming, tapping, etc. The book has twenty-eight pages of text and is bound with a heavy paper cover. Thirteen models are photographed, and the mechanical details and attachments are fully illustrated. A popular model in the Strand line is the M6, a portable outfit with a drilling capacity of ¾ inch and operates a grinding wheel 6x¾x½ inches. It is built for 110 and 220 D. C. or alternating 60-cycle single-phase current.

Exhibit of Indiana Oxygen Company at Indianapolis Industrial Exposition

A WELDING EXHIBIT THAT ATTRACTED ATTENTION

One of the novel exhibits of the Indianapolis Industrial Exposition was the display of the Indiana Oxygen Company, in the charge of J. R. Brant. This exhibit showed the wax figure of a man, representing a welder, bending over a fire-brick preheating furnace and welding a broken casting. The figure attracted much attention from the visitors, some of whom were unable to determine whether it was a dummy or a real operator.

PROCEEDINGS *of the* AMERICAN WELDING SOCIETY

33 West 39th Street, New York

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PRACTICAL APPLICATIONS OF THE ELECTRIC ARC WELDING PROCESS*

By E. Wanamaker†

IT lies within the possibilities of the American Welding Society to furnish much accurate information, but they should not be expected to go thoroughly into the details and commercial aspects, such as are or would be necessary for any business, or business organization, using the electric welding process as a means of profit to themselves. Therefore, any business expecting to profit by the use of the electric arc welding process not only should, but must be willing to procure and make good use of the services of a fully qualified welding engineer.

Any user of the process, whether he use one equipment or whether he use several hundred, should have the entire operation or operations, carefully and properly planned from conception to conclusion.

Every large user of this process should, before beginning use of same, arrange to secure the services of a fully qualified consulting welding engineer, to assist him in the arrangements, plans and preliminary welding, including the development of a first-class welding engineer to remain permanently in the business. Certainly, if it be possible, it would be well for the large user to engage or employ a permanent welding engineer at the outset, thus dispensing with the necessity for employing a consulting welding engineer.

Every small user should employ the services of a qualified consulting welding engneer, and just here it might be well to say, when we speak of welding engineers we mean a qualified welding engineer, as regards the electric arc welding process. Of course, in case it was a gas welding process that was being used, or was to be used, then the welding engineer should be fully qualified as a gas welding engineer.

The welding engineer should be fully competent to direct the purchase of the necessary proper equipment and materials for his clients, for proceeding with the practice of the art. He should also draw up complete general and detail specifications for their guidance, and each welding job should be included.

It is true that there are but few fully qualified and fully competent welding engineers available today, but there is no doubt but that a plentiful supply of such welding engineers will be available as the work progresses and the demands for same increase.

I am strongly inclined to the belief that the success of the electric arc welding process on the Rock Island Lines is primarily due to the foresight and vision of Mr. W. J. Tollerton, general mechanical superintendent, who some nine years ago came to the conclusion that there were great possibilities in the electric arc welding process, if same was properly developed and applied, and that great economies would accrue to the Rock Island Lines through its use.

Mr. Tollerton realized that if the development and application were to be successful, it would be necessary to develop a welding engineer, with a competent staff, to handle all of the branches of the subject.

Insofar as we are concerned, we have found that the three prime requisites, if successful electric arc welding is to be performed, are:

First. The proper equipment.
Second. The proper materials.
Third. Requisite skill.

The first primary factor necessitates an equipment that will give the actual heat application and heat control necessary to good autogenous welding, and one that will be the most facile possible to obtain. In other words, a skillful penman or artist can do much better work when supplied with the most workwise pen or brush—true, they might write or paint after a fashion with most any kind of an old pen or brush, even though far from suitable, yet the results would not be satisfactory.

It is possible today to purchase electric arc welding equipments that are satisfactory from a metallurgical standpoint, as well as from an electrical standpoint, and all qualified welding engineers are no doubt cognizant of the fact. However, it might be well to call attention to the following:

In considering a question of such importance as that of rating autogenous welds, the prevailing spirit should be not only to safeguard against the misuse of autogenous welds, but also to avoid unwarranted restrictions which may hamper the development and progress of the art. The growth of the welding art has already been retarded due to lag in perfecting the minor refinements of the various phases and not to any fundamental objections to the basic principles, which remain practically the same as from the conception of the art.

Many factors enter into the determination of the dependability of welded products. If proper consideration is given to these various factors, private and commercial interests should not be allowed to predominate. In the past, they have not infrequently been allowed to become involved in the conclusion, often to the detriment of at least some phases of an art or industry.

Paper read before the American Welding Society, Metropolitan Section, New York, Sept. 20, 1921.
†Electrical Engineer, Rock Island Lines.

The volt ampere characteristic and the stabilizing characteristic for arc welding circuits, if proper for ease of welding, must facilitate rapid variation of current and voltage, in response to variation of arc resistance. The shape of a volt ampere curve of a welding circuit may be proper and yet entirely unsatisfactory for welding, due to its slowness in response to the rapidly changing arc resistance.

The second primary factor—materials. There is a certain correlation between the parts to be welded and the material to be used in welding the parts, which it is necessary to consider for all classes and types of autogenous welding.

The thermal effect of localized heat on the structural arrangement of many kinds of metal is well known and is thought to be of sufficient importance to justify limitations of composition of materials to be welded. The cross section and thermal capacity will effect to a considerable extent structural changes caused from the localized heat.

The character of the metal from which the weld is constituted is a most important consideration in the quality of the weld. It is commonly admitted that the greatest deficiency in gas or arc fused metal is due to its low resistance to torsional, transverse and fatigue stresses. So far, improvements have been made in this direction only by affording better protection to the molten steel from atmospheric gases and by the use of alloy steels, the physical characteristics of which are not injured, but possibly improved by the heat cycle imposed by the welding conditions. Failure of welds due to strains of this character are also guarded against by reinforcement of the welded joint to a point greatly in excess of the elastic limit of the neighboring metal.

The third primary factor—skill—is sub-divided into engineering skill, supervisory skill and operator's skill—all of vital importance.

Any job is to be welded (whatever its nature) should —if the job is a new one, be designed with the view of facilitating autogenous welds. If the job be a repair job, the application of the autogenous welding process becomes a more difficult one, since the original design did not contemplate the use of autogenous welding.

The supervisor of welding must be educated to become the go-between or medium of exchange between the designing engineer and the operator in the field or in the shop.

The operator in the field or shop is concerned primarily only with being able to properly fuse the metal into the weld when the proper specifications are furnished by the welding engineer and when properly supervised by the supervisors.

Fortunately, today it is possible to obtain welding equipments having the characteristics necessary for securing good autogenous welds—that is, such equipments are very facile. Also it is today possible to secure welding materials required for the various jobs in hand.

Unfortunately, there is a great dearth or scarcity of welding engineers, due to the infancy of the art and the natural inertia of the human being to take up that which is new and that which is not understood.

Without these engineers, who have the requisite skill necessary, mis-selections or mis-choices are apt to be made by the people in the business field when they are purchasing welding equipments and welding materials. Likewise, it is unfortunate that while we have many skilled operators, provided they are working under skilled supervisors and engineers, it is evident (and quite naturally so) that we have only a few skilled operators who can proceed to make uniformly good welds when left alone—that is, when furnished with improper equipment, improper materials, improper design and improper supervision.

From the foregoing, it may be easily deduced that I am taking the part of the autogenous welding operator, and in one way I am—he has certainly been one very much abused individual. I might well ask the question what we would expect of a boilermaker if some engineer did not properly design the job, purchase the material, design the proper tools, etc., in order that this boilermaker might shear some sheets and drive some rivets. For instance, I have found that it is possible to secure uniformly good welds, provided the design, engineering for the job and the welding, has been properly performed, and competent supervision provided.

Occasionally we have found a man who would not make a good welding operator and he was encouraged to leave the welding art alone and work at something for which he was suited. Just here it might be well to say that an autogenous welding operator (referring now to the gas and electric process) requires a welding wrist, which is somewhat similar to the telegrapher's wrist, or the wrist of an artist. There is a certain dexterity and movement required in securing good autogenous welds, insofar as the operator is concerned. A steady nerve and a quiet nerve is a highly important requisite, the same as with a skilled penman, and it is a well known fact that an artist, a penman or an expert telegrapher using the Morse key, cannot do good work if they are called upon to lift, heave and haul, and so strain their muscles, or upset or jar their nervous system. Hence, welding operators should not be called upon to do heavy manual labor. In other words, their welding wrist and nerves should be preserved. It may be that we are laughed at for making such a statement, but we have come to this conclusion after several years' handling of more than 350 operators working only on high grade welding, where the best equipment, material and skill is required.

The ability of the welding operator has always been an unknown factor and probably always will be. A certain qualification of operators is obviously necessary. With proper design and prescribed methods of application and competent supervision, operators who have had the proper preliminary training and the usual amount of experience required to train the average student welder, will produce surprisingly uniform results.

The great differences in the efficiency of welds obtained by different operators have in some cases been due as much to the differences in design, methods of procedure, etc., as to the difference in the ability of the operators concerned. Sight should not be lost of the fact that most of the welding done in the past has been dependent upon the operator to work out all the facts enumerated above in addition to performing the weld, and in many cases improper designs and methods of application have been employed, resulting in many undue failures.

The duty of the operator should only be to form the weld as physically sound as is humanly possible. The weld design, method of application and welding material best suited for the work at hand should be predetermined by test and research, according to the requirements of the welded products.

Equipment installation is an important factor. Having only two standard power voltages on the Rock Island, 440 volts 3-phase 60-cycle a. c., and 250 volts d. c., we have only two types of welding equipments, as far as power supply is concerned. Each power outlet is provided with a safety type fuse switch and receptacle, with plug and power connector to correspond. This form of connection is used even where stationary equipments are in service, since at any time it may be desired, the stationary equipment may be transferred to some other point, and a portable equipment used where the stationary was formerly employed.

Stationary equipments are used in shops where there is sufficient work always immediately adjacent to the equipments to keep them busy. We have found that a welding unit or equipment with a capacity of 200 amperes for continuous welding (manual operation), such as will permit the occasional

use of approximately 225 amperes for intermittent work, and in emergencies, 250 amperes for a short time, is best suited to our use for all ordinary work.

We also use a very few similar equipments, except that the corresponding ratings are 300 amperes—approximately, 350 and 400. These machines are necessary where speed is an imporant factor when welding very heavy sections with large coated electrodes, the coated elecrode making this possible.

These equipments are all purchased according to Rock Island specification, which in brief is as follows:

200 *ampere capacity* for continuous welding duty (manual operation), 65 volt max. open circuit voltage, portable electric metallic arc welding equipment, complete with control panel and motor starter. Welder set to be equipped with radial ball bearings. Truck to be equipped with ball or roller bearings. Cleat for 150 ft. of No. 2 cable, sheet metal cover with side and end curtains, to make entirely weatherproof. To operate on 3-phase, 60-cycle, 440 volt, a. c. circuit.

Motor to be constructed so as to be easily re-connected for 220 volts. In case the power circuit is d. c., the motor should be a 250 volt d. c. motor.

The welder shall be provided with suitable means for conveniently reversing polarity of welding circuit. The arc welder shall possess proper characteritsics for good welding in all positions for arc current values from 50 to 200 amperes, as demonstrated by experienced operators, without causing undue fatigue on the part of the operator.

Suitable means shall be provided for adjustment of current from 50 to 200 amperes, in steps of not more than 7½ amperes.

300 *ampere capacity*, portable electric metallic arc welding equipment, for continuous welding duty (manual operation), 65 volt max. open circuit voltage, complete with control panel and motor starter.

Welder set to be equipped with radial ball bearings. Truck to be equipped with ball or roller bearings, cleat for 150 ft. of No. 0 cable, sheet metal cover with side and end curtains to make entirely weatherproof. To operate on 3-phase, 60-cycle, 440 volt, a. c. circuit.

Motor to be constructed so as to be easily re-connected for 220 volts. In case the power circuit is d. c., the motor should be a 250 volt d. c. motor.

The welders shall be provided with suitable means for conveniently reversing polarity of welding circuit. The arc welder shall possess proper characteristics for good welding in all positions for arc current values from 50 to 300 amperes. As demonstrated by experienced operators, without causing undue fatigue on the part of the operator.

Suitable means shall be provided for adjustment of current from 50 to 300 amperes, in steps of not more than 7½ amperes.

We now have practically every shop, terminal, car repair yard and roundhouse of any importance, equipped with electric arc welding equipments, and expect next year to equip even the turn-around points. We find, however, that we are having to increase the facilities at all points—in fact, there seems to be no end to the growth and development in the application of the arc process to motive power, rolling stock, tracks and structures.

Due to the two standard voltages and our method of installation, we are able to use practically our entire equipment as a "flying squadron"—when the work or demand decreases at one point and increases at another, we are able to transfer the equipment, simply by loading into a box car or, if necessary, a baggage car, and shoot same to the point needed, where it is immediately available for service upon receipt.

The application of this process to car work is growing very rapidly just at present, and we will in all probability require a total of 150 equipments during the coming year. At the present time many of our equipments are double crewed and a few of them triple crewed.

Some track work has been performed with the portable shop equipment wherever power circuits were available.

We are now developing district electric welding cars for track and structural welding. For instance, a good box car will be converted in one end for living quarters for the welding crew, consisting of at least two men for a single unit car and three men for a double unit car. The other end of this car has large end doors. Portable runaways are carried with the car and used for loading and unloading the electric welding unit or units, in case two are carried.

These units are weatherproof and are built to the same specifications as the generators for our standard welders, and are driven by high grade gas engines having smooth power impulse. The generator and engine are assembled on skids, which in turn are placed on well built push cars which may be moved about over the tracks from place to place by hand, or in case they are out on the line, can be trailed behind a section motor car. Each car is also equipped with a gas cutting torch and portable motor driven electric grinders and drills.

Before this car is sent to a large yard for reclaiming track work, the track foreman in charge at that point is instructed to have all his foundation work, frog bolts, etc., put into first class condition by local force, so that the welding crew will have nothing to do but the welding. The work is handled in a similar manner when out on the line. This gives by far the greatest economy, and insures the actual welding work being performed by experts, who are not required to do any other kind of work for reasons mentioned heretofore in this paper.

All of this welding, whether on carbon steel or manganese steel, is done with the coated high manganese electrode. Just here it might be well to state that in speaking of the electric arc welding process, as applied to our railroad, we automatically refer to the metallic arc welding process, as we do practically no carbon or graphite electrode welding at the present time, our endeavors having been confined to the development of metallic arc welding in view of its greater simplicity and we feel, generally speaking, better results.

We are glad indeed that we were so fortunate as to base our primary decision on the system method of equipment organization, as it has no doubt eliminated some very serious handicaps that might have otherwise occurred—at the same time we endeavored to build up a system organization, as regards the engineering, supervision and operation of this equipment, to the end that the greatest possible benefits might be obtained.

The fact that the Rock Island lines has a most excellent laboratory and test department, in charge of Mr. T. D. Sedwick, has been very much to our advantage, since the laboratory is especially well equipped for metallurgical work, and Mr. Sedwick and his staff are intensely interested in the development of the art, so it might be said that we had a foundation on which to start our operations.

A $50,000 investment was made in the initial start for equipment, and one of my assistants, Mr. H. R. Pennington, who seemed to have a natural talent and acquired intense desire to become proficient in this new art, was appointed "Supervisor of Welding and Electrical Equipment." As the work has increased, he has in turn been given two assistants, both of whom were boilermaker craftsmen, and who during the development of the art, became very proficient in all forms of autogenous welding and its application to all branches of railroad work.

We carefully taught our electricians how to install and maintain all of the electric arc welding equipment—at the

same time we endeavored to teach all the operators the necessary detail and to supervise their work, and endeavored to impart as much information as possible to the heads of our motive power, rolling stock, and maintenance of way departments, including district officers, division engineers, shop superintendents, master mechanics, general foremen, foremen, etc., since it is necessary to have as many conversant with the art as possible, if success is to be obtained.

All local points are encouraged to develop new methods and new applications of the art, same being checked by the supervisory organization before actual tests are made. All tests—both actual service and laboratory—are conjunctive. Indeed, we feel that it is the combination or co-operation of laboratory and practical service, research and tests, etc., that are responsible for many of the good results obtained.

The duties of the traveling supervisors and instructors, as their title implies, consist in instructing, supervising and checking, so that no operators are permitted to make important welds unless they have been approved by the welding supervisory organization.

As the work progressed, it became necessary and highly desirable to prepare a general welding instruction and standard practice, so that all who desired information on this subject, would have a means of acquiring same in the shortest possible time—also, so welding operators could acquire all necessary detailed instructions such as would permit a great shortening in the period of time required for making a kindergarten or student operator proficient enough to make welds of the simplest kind and who within a few months after attaining this stage, would be able to make the most important welds with uniformly good results. This specification at the same time outlining the standard practice which should be followed for the various jobs or types of jobs, especially those with which difficulty might easily occur.

This standard practice and instruction when completed a few months ago (in the meantime we have had a couple of temporary practice and instruction books issued) as a result of two years continued effort, was given the official identification of "specification No. 455-A." This specification is copyrighted and the various books issued are given an individual number, and when issued to the line, receipt is required for same, the books remaining the property of the company. These books are perpetual, and from time to time as revisions become necessary, they will be mailed out for inserting in the book in place of those parts that are annulled.

This specification is only about one-third up to date, and we hope during the coming winter to make up fully 50 per cent of the shortage, although developments are continuing so rapidly that this may not be possible. However, it is our intention to keep this specification as near up to date as our combined efforts will permit.

All of the departments and persons using the electric welding art are now so interested in its development and further application, since they have learned the tremendous financial savings that are affected, that we have extreme difficulty in keeping up with them.

Every arc welding job is a job in itself and if it is to be properly done so as to secure the best ultimate results, it should be fully covered by complete specification. It certainly is not within scope of this paper to give a long list of detail specifications, but we will at least give the table of contents from our copyrighted Rock Island lines electric arc welding instructions and standard practice, spec. 455-A, in an endeavor to outline our general plan of handling specifications:

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THE FOLLOWING LIST INCLUDES MANY OF THE WELDING JOBS THAT ARE PERFORMED AS A REGULAR PRACTICE. UNDER TRACKS ARE INCLUDED CROSSINGS, FROGS AND SWITCHES. UNDER STRUCTURES ARE INCLUDED TANKS AND VARIOUS TYPES OF FABRICATED STEEL STRUCTURES, AS WELL AS SOME CAST STEEL STRUCTURES AND A FEW CAST IRON STRUCTURES.

FREIGHT CAR CARLINES, BRACES, CORNER POSTS, DOOR POSTS, GUSSETS, ETC., WELDED

NOT CLASSIFIED
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Detailed description or instructions for any particular job or jobs must of necessity be handled in detail papers. However, it might be well to include a few words on weld inspection and weld records.

It is generally admitted that imperfect soundness of a weld structure is the most common cause of failure of a welded joint. Knowing the factors responsible for these imperfections in soundness and the conditions necessary to eliminate their existence, should leave little or no excuse for their occurrence.

The factors responsible or contributory to unsound arc welds are: (1) Poor fusion, (2) slag inclusions and (3) porosity. Of the different methods of inspection to determine the character of welds, the most practical are:

1. A Visual Examination to Determine
   (a) Appearance of weld surface as an index to workmanship.
   (b) Uniformity of deposit as an indication of faithfulness with which fused-in metal is placed in position and, therefore, ability to manipulate arc.
   (c) Existence of slag and presence of porosity as evidenced by appearance of deposit surface and uniformity of fusion between deposits.
   (d) When conditions permit, fusion of deposited metal to edges at bottom of "8" by inspection of reverse side of joint.
2. Chipping base of deposits with cold chisel to determine adhesion of deposit and ductility of fused-in metal. If the chipping breaks short like a poor grade of cast iron, it is a fair indication that the metal is burned (oxidized), due to excessive heat or excessive arc length. Welds composed of such metal will break comparatively easy when subjected to transverse stresses.
3. Penetration test to detect linked gas pockets, slag pockets, porosity and unfused zones. While there are a number of possible methods that may be used to detect such weld imperfections, the penetration test offers the most reliable indication of unsoundness extending through the weld section, isolated unfused zones, globule inclusions, gas pockets, etc., will of course not be detected by the penetration test.

Kerosene is a most effective liquid for this purpose and it is unusually easy to obtain. When sprayed on one side of a welded joint, if there exists a chain of unfused zones, slag pockets, gas pockets, porosity, etc., through the weld section, the kerosene will be drawn into the capillaries produced by the imperfections and if these extend through the section, a stain will appear on the reverse side of the joint. This method will be found convenient and effective to determine whether or not a joint is leak proof to water, air, steam, oil, etc.

In addition to the visual examination of welds and penetration test, operators should check their aptitude by welding sample pieces of boiler plate together under conditions similar to those encountered in practice. By bending to a point of rupture and noting the angle of bend and the appearance and structure of the weld metal will give fair evidence of his ability to produce a sound weld and the nature of the defects found, if any, will be suggestive to the operator as to their cause. While it is quite possible for a weld to contain a number of small distributed imperfections without greatly affecting its quality, they should be eliminated to as great an extent as possible. Foreman should occasionally require operators to make test of this nature in order that both may know the quality of the work that can be produced.

A further check may be made by submission of welded samples to an engineer of tests. To obtain tensile test, samples should conform to standard coupons.

It is probable that a record of all important welds is most easily made and maintained by using some such system as is employed on the Rock Island Lines, which consists of having the following record legibly stamped on the weld by at least ⅜ in. steel stencils in the following form:

E.

(Mo.—Day—Yr.)
(o — O — o)

Railroad
A B C

Local shop symbol or shop abbreviation mark.

Welder identification number or mark.

E. Denotes electric weld

In case of any industry other than a railroad, the name of manufacturer or firm should be substituted in place of the name of the railroad.

Some of the most recent developments include the use of high manganese for certain wheel flanges where wear is very excessive, also the splicing of center and side sills of steel under frame for freight car, including draft gear support—all entirely arc welded without a rivet.

Some time ago we developed a diagonal strapped butt welded joint for high pressure and heavy loads, which is giving excellent service and promises to be extremely successful. All parts of this joint are similar to all other important welds, and practically all welds are important (at least insofar as railroads are concerned) are carefully fitted wth perfectly smooth surfaces provided for applying the added metal.

We are not attempting to show any statistics as regards individual savings, or economies effected, since this would require long drawn out mileage and service tables for various parts, with qualifying statements and description of far-reaching effect of indirect savings, necessary for intelligent comparison. However, we might well say that in checking our records last spring, we found that on an investment of $150,000 for electric arc welding equipment, we are realizing an annual net return of approximately 300 per cent. This figure will not hold for future and additional equipment, since we have already reached the point where 40 to 50 per cent is all that might be possible in many instances, as we have about exhausted the jobs on which such tremendous savings can be made, and the only savings possible to effect will be the direct saving over some other process of manufacture or repair, the essence of time factor, etc., not being felt.

In drawing up our general and detail welding instructions and specifications, we have this slogan constantly before us, "The best is none too good," and we include engineering, design, supervision and operation, as well as equipment and materials. Also, we have one other slogan which may be said to be secondary to the primary slogan "The best is none too good"—that insofar as autogenous welding is concerned, "Cleanliness is ahead of Godliness."

Viewing this art or process from a somewhat academic standpoint as well as from the standpoint of the technician or commercial user, we are forced to the conclusion that there are two general types or classes of autogenous welds—based on atmospheric interference, "The protected weld" and "The unprotected weld."

We are all familiar with the thermit and gas welding methods and the means taken to secure as far as possible "Protected welds." Hence, since the scope of this paper is limited to the electric arc welding process, we will deal with protected and unprotected electric arc welds, which is in turn confined to the metallic arc process.

Our years of experience indicate that the metal passing from the end of the electrode into the weld is in a highly molten state, indeed a generous proportion of it in a gaseous state, and therefore extremely susceptible to atmospheric effects, even though the journey through the atmosphere is a short one. By the use of such coated electrodes as are used on the Rock Island Lines, we were able (to a large degree) to eliminate this damaging effect. Indeed not only were we able to protect the iron and low carbon content steel electrodes, but to go further and protect the various alloys, the use of which is extremely desirable to meet certain conditions. Such alloys as tungsten, nickel, vanadium, chromium, molybdenum and manganese meeting some very necessarily important demands.

Electrodes to have any real value must be carefully produced to meet the necessarily exacting specifications which in turn were only possible as a result of the combined prolonged efforts of those engaged in scientific research, development and application.

To produce such electrodes, much expense is incurred over and above the production of mere wire, but in this and in no other way is it possible to produce the proper electrode with the proper welding characteristics for the job in hand and secure a "Protected weld." Even so a comparison of high grade electrode costs compared with per pound prices of steel castings, high grade steel, etc. (long ago deemed necessary), causes one to marvel at the low electrode cost. It would seem reasonable to believe that we could no more secure good electric arc welds with poor or unsuitable welding material than we could expect to build machinery or structures out of poor or unsuitable materials.

In writing specifications, the section dealing with inspection and test, should give consideration not only to the tensile strength test, but also to impact and breathing test, repeated and alternate stresses, etc.

It is today possible to make very high tensile welds, but the consideration of this factor alone is not sufficient, especially when attention is called to the aging of iron and steel, and the effects of fatigue in connection therewith, the percentage of elongation obtained by some of the methods for testing welds is not a criterion—the elongation of the original stock depending to a large degree on the tensile strength of the added metal. However, in the great majority of engineering designs where autogenous welding is used, the elongation in itself is not such an important factor, provided the impact, breathing, repeated and alternate stress tests show sufficiently good to resist fatigue.

When the railways first went to the cast steel truck side for car work, the primary object was to get away (in the instance of freight cars) from the failure of truck frames, due to the eventual cracking of arch bars at bolt holes, or at points where the arch bar has a gamber or angle when formed to produce the arch section or structure, also the elimination of bolts and the continual loosening of same, which either caused eventual truck failures, or required an excessive amount of labor for maintenance. Apparently the wrought iron or rolled steel bar, when of proper section, etc., was entirely satisfactory, except for the weakness as mentioned above. In other words, they were not easily effected by metal fatigue, the crystalline structure of wrought iron and rolled steel being such as to strongly resist the tendency to fatigue.

For somewhat similar reasons, the railways also began the use of cast steel truck and body bolsters. At about the same time the cast steel truck side came into use.

As the result of several years' close watching and checking, we find that the cast metal is much more liable to fatigue than is the wrought iron or rolled steel. For instance, the bolsters and truck sides, for an average of say five years, stand up successfully. However, at about the sixth year, they begin to crack and fracture due to fatigue.

We have found that where the manufacturer has been careful to prevent, insofar as is possible, the atmospheric effects when the casting was being poured, and to eliminate contraction strains by subsequent annealing, better material was secured with reduced liability to fatigue and failure. Also when this fact is recognized, and the proper sections and distribution of the metal used in the casting, that the life can be greatly extended. In fact, today, we are repairing these defective bolsters and truck sides by reinforcing the entire weak section by using a wrought iron or rolled steel part of sufficient strength to meet the demands, same being applied by the electric arc welding process. The entire job is then thoroughly annealed in order to restore the physical condition of the member that has been repaired, also to reduce any thermal effects that may have been produced by the localized heat in welding.

Inasmuch as the autogenous welds (referring primarily to electrc arc and gas) are metal in cast form, it seems to me in drawing specifications, we should continually bear in mind the effects of fatigue and locked-in or contraction strains and stresses since it is evident that fatigue much more quickly effects cast steel than it does wrought iron or rolled steel. For instance, fatigue may not effect the wrought iron or rolled steel material in less than thirty years, while it might effect the cast steel, such as is in an autogenous weld, in approximately six years; that is, based on our truck side and bolster experience. However, the vibration of truck sides and bolsters is heavier and more severe due to the various impact, repeating and reversing stresses set up in them due to the continuous pounding, jolting and jarring over the tracks, than would be, for instance, in boilers. In boiler work we do have the vibration and fatigue, only it would seem it would take a much longer period of time for the effects to accumulate sufficiently to show. For instance, a low pressure boiler, say with a 15 pound pressure limit, if designed and welded under proper specifications, may not show any of the effects of fatigue for 15 or 20 years, and then at that time show fractures or cracks such as would probably cause leaks—also, mean a failure of the vessel. If, however, steps are taken to prevent as far as possible atmospheric interference with the metal placed in the weld, it is very probable that this trouble would never occur.

You will probably note that I am endeavoring to look far into the future, and the time element is a very important factor for consideration.

In the welding of unfired pressure vessels, say to 125 or 150 lb. limit of pressure, it would seem that the consideration of fatigue should be given the same careful study and attention, for while it is true that in a fired low pressure vessel, we have in addition to the vibrations, the movement due to expansion and contraction, caused by the alternate heating and cooling effects, we do have in many cases far more vibration, with a pressure far more apt to cause rupture which may or may not be disastrous, and the specifications for unfired pressure vessels with a limit of 150 lbs. should be given, to say the least, as much careful consideration as the fired pressure vessel with a 15 lb. pressure limit.

The recent study and survey would, to say the least, seem to indicate the necessity for all regulatory bodies drawing rigid specifications to govern autogenous welding in all cases where failure might cause loss of life or heavy property loss.

These specifications should be prepared by or through the conjunctive work of all interested regulatory bodies, including insurance bodies—that is, those having to do with boiler construction including buildings, edifices and structures, railroads, vehicles, etc.

This job is of some magnitude, but it is not as difficult a job as would seem at first notice, for we are today in possession of sufficient facts and data to enable us to draw up specifications covering certain ranges or limitations allowable at the present time, and from year to year, or from period to period, this range or limit can be extended, as improved and increasing facilities permit.

These specifications could probably best be prepared and issued in book form sub-divided into various sections.

The code developed for boilers by the A. S. M. E. and the code for electrical work as developed by the National Board of Fire Underwriters, might well serve as guides or examples in preparing these specifications. These specifications of necessity should fully cover the three prime requisites, so that none but the proper equipment and the proper materials for the job in hand be acceptable—material, including the original material to be welded and the welding material to be applied in the weld, there being a certain correlation between the two. Likewise, the permissable methods, including engineering, supervision, and operation, should be fully specified in detail. These specifications can be placed in universal service by federal, state and municipal governments, as well as by all other regulatory bodies.

It would seem that this is the foundation of the entire instructive and governing structure which must be erected before the electric arc welding process can achieve the universal use which it deserves. A superstructure consisting of detailed instructions and specifications can then easily be erected on the completed foundation.

NOVEMBER MEETING OF CHICAGO SECTION

The date for the November meeting of the American Welding Society, Chicago Section, has been changed from November 25 to November 23. Starting with December meetings will be held on the first Friday of each month instead of the last Friday of each month, as previously announced. Meetings will be held in the auditorium of the Western Society of Engineers, Monadnock Building, Van Buren and Dearborn Streets, Chicago.

The business of the Michler & Zastrow Welding Company, of 51 West Second Street, Fond du Lac, Wis., has been dissolved and will in the future be operated by Otto F. Michler, X. A. Zastrow retiring. A machine and forge shop will be installed by Mr. Zastrow at 193 Military Street, Fond du Lac. Oxy-acteylene welding and cutting apparatus will be part of the new equipment.

Plans have been filed by the Oxweld Railroad Service Company for a new generator storage house at Buffalo, N. Y. The building will be 51x156 feet and will cost $6,000.

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Portable Electric Welding Outfit Operated by 10 H. P. Novo Engine Makes Emergency Repairs in Few Hours for Plants Which Otherwise Might Be Crippled for Days.

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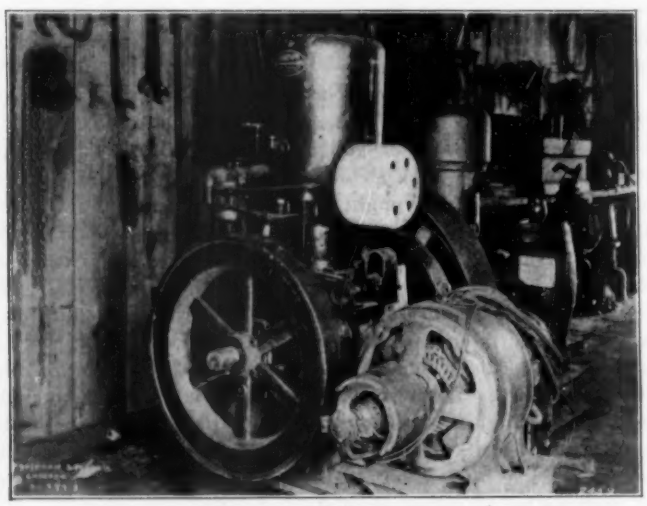
"This equipment consists of an electric generator and a 10 H. P. Novo engine to furnish the power, mounted on a motor truck. It is designed for use on emergency jobs anywhere within 50 miles of our plant. The engine is always ready for use; and with this outfit we can handle almost any kind of a welding job, regardless of where it is located.

"Electric welding apparatus is too expensive and too little needed for the average plant to carry such equipment. When it is needed, however, it is wanted very badly, and the lack of it may tie up the whole plant. Our portable outfit is specially planned to take care of jobs that must be handled quickly and on the spot, as when a firebox lets go, or a boiler de-



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velops a leak, in a plant having no facilities for welding. It also handles such minor jobs as are brought to our plant.

"Most of our outside work is on boilers and other machinery in industrial plants. A great deal of it is calking edges, welding flues, and welding on combustion chambers where very careful work is required.

"By equipping our generator with a gas engine we have made sure of always having power available to operate our welding machine. Owing to the different combinations of voltage and current, it would take a large number of machines to be able to operate using the various types of current, and we must have a direct current of about 20 volts and 50 amperes. A steam power unit would not only be very expensive and slow in getting started, but would also be so heavy that it would be almost impossible to carry it on a truck. The use of a gas engine to run our generator is a very practical solution of this problem.

"The generator is connected with the engine by a belt, and this type of drive has proved entirely satisfactory. When operating steadily the engine consumes about 10 gallons of gas in 8 hours on ordinary work. This gives the generator a capacity of 150 amperes at 20 volts, which is a very good, average welding current.

"The number of days this outfit operates, and the amount of work it handles, vary greatly. Sometimes it is kept going steadily 4 or 5 days at a time; at other times it may not work for several days. It is safe to say, however, that this machine operates on the basis of 200 working days a year, and averages about 4 hours a day. Figured on Gould Reports Form 70, the operating cost of the outfit is $2.79 a day, and 69 cents an hour.

"These costs include depreciation on a 10-year basis; a total allowance of $100 a year for maintenance and repair; and the cost of gasoline and oil. No charge is made for the labor necessary in handling the welding apparatus, as this is not considered a part of the operating cost; but two men are required on ordinary work. The few minutes per day required to look after the engine are included in the maintenance charge. There have been no repairs nor trouble to date.

"Generating electricity for welding work is exceptionally hard on the ordinary gasoline motor, as it goes from no load to a full load in an instant, and vice versa. The instant you strike an arc it requires a full load, and breaking the arc releases the load.

"If, for example, we used a 4-cylinder motor on this operation, the exceedingly high speed required with an engine of this type would cause the motor to race and burn itself up in a short time. Again, when the full load was turned on suddenly, as it must be in welding work, it would place a very great strain on the motor. The ordinary gas engine will not stand up long under this strain; but the Novo engine, having a throttling governor, maintains a fixed speed whether the load is on or off.

"This welding outfit has given us a very mobile piece of equipment, which can be started instantly, and which works very economically and dependably."

A summary of the cost of operation is given in the following report:

Report No. 3, BDK. Date 6-21-21-D1.
Owner, Western Welding & Equipment Co.
Address, 1035 W. Lake St., Chicago.
Operation, Driving generator on welding machine.

Analysis of Operation—Units handled daily. Hours operated, 4 hours daily. Period covered, 6 months to 6-15-21. Days operated, 200.

		Period Cost
Investment and Depreciation—		
Cost of engine—established life 10 years	$485.00	
Cost of additional equipment—established life 10 years	900.00	
Total depreciation yearly, $138.50 pro-rated for period		$138.50
Fixed Expense—		
Average interest	$ 45.70	
Maintenance and repairs—engine	50.00	
Maintenance and repairs—balance of outfit	50.00	
Insurance	3.00	
License or bond	.....	
Taxes	5.00	
Storage	.....	
Total yearly	$153.70	
Prorated for period		$153.70
Variable Expense—		
Fuel cost, 1,000 gallons at 25c per gallon	$250.00	
Lubricating oil, 25 gallons, at 70c per gallon	17.50	
Total period	$267.50	$267.50
Labor Cost—		
Operator ..... Days $....., per day $.....		
Helper ..... Days $....., per day $.....		
Total period	$.....	$.....
Total cost for period		$559.70
Total cost per day		2.79
Total cost for hour		.69

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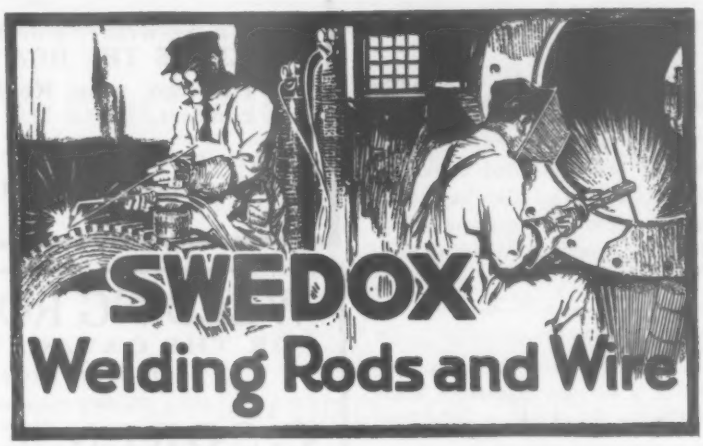

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Position Wanted—as arc welder or demonstrator, New York or vicinity. Minium salary, 60 cents per hour. Address 10, care The Welding Engineer.

Position Wanted—Oxy-acetylene welder of exceptional ability wishes to connect with a reliable firm in need of the services of a man capable of handling such a department. Age 27. Married, reliable. Can increase your business. Address 11, care The Welding Engineer.

Used Outfits For Sale—Fifty complete Oxweld Acetylene type W-1, 67½-degree welding torches with regulators and hose, all in A-1 condition and used only about 1,000 hours. Petroleum Steel Package Co., 564 West Randolph Street, Chicago, Ill.

Position Wanted—Arc welder with nine years' experience, two years as foreman, wishes to connect with a reliable firm in need of the services of a man to handle such a department. Best reference. Address 12, care The Welding Engineer.

Position Wanted—Thoroughly reliable acetylene welder with 10 years' experience wishes a position. Can furnish A-1 references and passed civil service examinations. Served in the late war as a welder. Married. Willing to work anywhere. Address 13, care The Welding Engineer.

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Statement of the Ownership, Management, Circulation, etc., required by the Act of Congress of August 24, 1912.

Of The Welding Engineer, published monthly at Chicago, Ill., for October 1, 1921.

State of Illinois, County of Cook.

Before me, a Notary Public in and for the State and county aforesaid, personally appeared L. B. Mackenzie, who, having been duly sworn according to law, deposes and says that he is the Publisher of The Welding Engineer and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 443, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:

Publisher, L. B. Mackenzie, Chicago, Ill.

Editor, L. B. Mackenzie, Chicago, Ill.

Managing Editor, L. B. Mackenzie, Chicago, Ill.

Business Manager, L. B. Mackenzie, Chicago, Ill.

2. That the owners are: (Give names and address of individual owners, or, if a corporation, give its name and the names and addresses of stockholders owning or holding 1 per cent or more of the total amount of stock.) The Weling Engineer Publishing Co. L. B. Mackenzie, 7131 Crandon Ave., Chicago; M. J. Hungerford, 6107 Dorchester Ave.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.) None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

5. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the six months preceding the date shown above is. (This information is required from daily publications only.)

L. B. MACKENZIE.

Sworn to and subscribed before me this 26th day of September, 1921, Stella I. Lindquist. (My commission expires November 7, 1923.)

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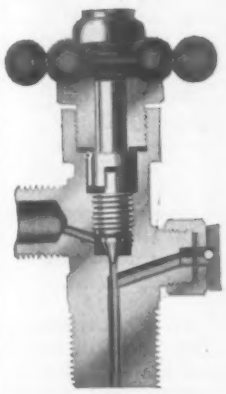

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CURRENT WELDING LITERATURE

AUTOGENOUS WELDING IN RAILROAD SHOPS—From special and topical committee reports of the Master Boiler Makers' Association. Autogenous welding used by every railroad visited and in most cases successfully. Committee is satisfied that welding of fireboxes is generally successful. Inexperienced operators, poor welding material and improperly prepared work have been responsible for failures. Keep inexperienced men out of fireboxes. Welding flues successfully depends on local conditions. Recommends oxy-acetylene welding for repairing and building of boilers. —Boiler Maker, October.

BROADENING THE USE OF WELDING IN SHIPBUILDING, by F. B. Webster—While there has been a rapid growth in the use of welding on the non-structural members of vessels building in the shipyards and a still more rapid growth of its use in repair work, the ambitions of the sponsors of this method of fastening metal parts together will not be satisfied until the practically rivetless ship is the rule rather than the exception. Before this goal can be reached, however, there are many obstacles to be overcome and among these difficulties none is greater than the present method of ship construction which is designed for riveted rather than welded connections.—Marine Engineering, November.

WELDING RODS FOR OXY-ACETYLENE WELDING, by J. R. Dawson—The function of the welding rod is to supply metal that is added during the welding operation to form a part of the weld. The old practice of using any old filler rod, has been the cause of many failures. It is essential that rods be made by good manufacturing practice besides having the correct chemical composition. Purchasers of rods can protect themselves by careful inspections and tests.—Acetylene Journal, November.

THE FUTURE JOB WELDING SHOP, by G. O. Carter—The successful job welding shop of the future will be operated on a real business basis. Modern equipment can be installed at a lower cost than might be imagined, if care is used in planning the complete shop. Continual advertising will keep up public interest.—Acetylene Journal, November.

WELDING IN REINFORCED CONCRETE CONSTRUCTION, by Marcelle Piette—One of the most recent uses found for oxy-acetylene welding is in connection with reinforced concrete construction. The reinforcing material has a great many joints which can be made most advantageously by fusion welding, and thus a broad field of activity is opened up for the torch.—Revue de la Soudure Autogene, September.

BRINGING THE WELDER TO THE JOB, by David Baxter—The portable feature of the oxy-acetylene welding outfit is a blessing. A good assortment of tips and rods should be taken out with the portable outfit, so as to be prepared for every emergency. —American Blacksmith, Auto and Tractor Shop, October.

INSTRUCTION BOOK—Operator's instructions for the use of the quasi-arc welding process. Pocket size handbook showing how to prepare work and outlining procedure for various types of jobs. Issued by Quasi-Arc Weldtrode Co., Inc., Peekskill, N. Y.

MAKING CHEAP LATHE TOOLS, by David Hampson—A specially shaped cutting tool may be prepared by adding a previously formed blade to a shank.—Automobile Dealer and Repairer, October.

WELDING TECHNIQUE—A small journal for the promotion of the science and art of welding. An outline of the method of indexing, the business and proceedings of the American Welding Society. Copyrighted by W. T. Bonner, Philadelphia.

THE SCIENTIFIC SIDE OF WELDING, by E. A. Atkins—The most common defects in welds are low tensile strength and poor elongation. Structure and physical properties of metal depend on chemical composition, heat treatment, and mechanical treatment, therefore it is difficult for a welded joint to have proper chemical composition and also the requisite physical properties.—Acetylene and Welding Journal, London, October.

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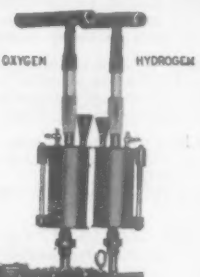

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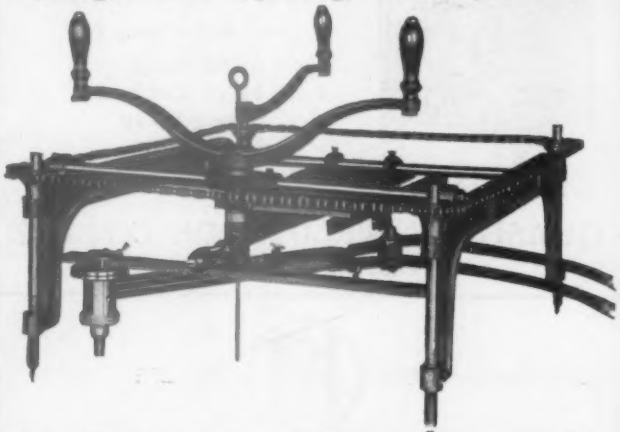

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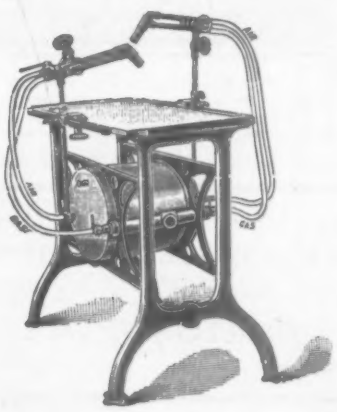

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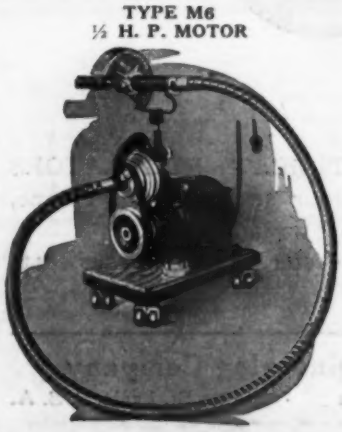

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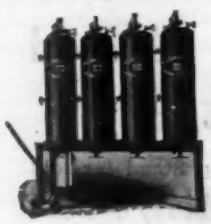

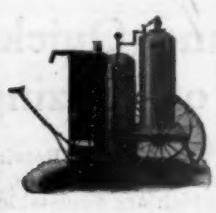

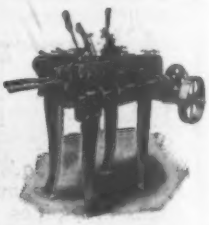

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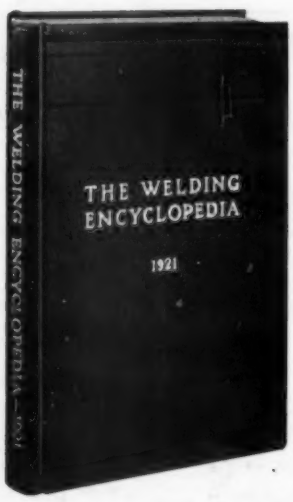

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